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The ant tribe Tetramoriini (Hymenoptera: Formicidae)

The genus *Tetramorium* Mayr in the Malagasy region and in the New World

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Synopsis

The ant genus *Tetramorium* (=*Xiphomyrmex*) is revised for the Malagasy region and the New World, separate keys being given for each. Thirty-six species (29 endemic) are recorded from Madagascar of which 15 are described here as new; five new synonyms are established. Eleven valid species are recognized as occurring in the New World, of which four are endemic; two species are newly described and six new synonyms established in this section. Additions and corrections to the first two parts of this study are included.

Introduction

This is the third part of a series of papers covering the taxonomy of the ant tribe Tetramoriini. Part one (Bolton, 1976) defined the tribe and its constituent genera and reviewed or revised the

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smaller genera. The second part (Bolton, 1977) dealt with the genus *Tetramorium* in the Oriental, Indo-Australian and Australasian regions and this present part covers the faunas of the Malagasy region and the New World. A fourth part, at present in preparation, will deal with the genus *Tetramorium* in the Ethiopian region, by far the largest fauna with over 150 species known to date.

The Malagasy fauna consists of 36 known species and has not previously been monographed, whilst the New World has 11 species, four of which are endemic and seven of which are introduced. The New World forms were previously examined by M. R. Smith (1938; 1943), with additional later information from Creighton (1950) and Brown (1957; 1964*a*).

Fuller discussion of the regional faunas is given under their respective sections.

This paper also deals with new species from the Oriental and Indo-Australian regions which have been found since the completion of the second part in 1977, and corrects a couple of errors made in the previous parts.

Measurements and indices

Total Length (TL). The total outstretched length of the individual, from the mandibular apex to the gastral apex.

Head Length (HL). The length of the head proper, excluding the mandibles, measured in a straight line from the anteriormost point of the median clypeal margin to the mid-point of the occipital margin, in full-face view. (In species with a strongly concave occipital margin the head length is measured to the mid-point of a line connecting the posterolateral projections.)

Head Width (HW). The maximum width of the head behind the eyes, measured in full-face view.

Cephalic Index (CI). $\frac{HW \times 100}{HL}$

Scape Length (SL). The straight-line length of the antennal scape excluding the basal constriction or neck close to the articulating condylar bulb.

Scape Index (SI). $\frac{SL \times 100}{HW}$

Pronotal Width (PW). The maximum width of the pronotum in dorsal view.

Alitrunk Length (AL). The diagonal length of the alitrunk in lateral view from the point at which the pronotum meets the cervical shield to the posterior base of the metapleural lobes or teeth.

All measurements are expressed in millimetres.

Abbreviations of museums

AMNH, New York	American Museum of Natural History, New York, U.S.A.
BMNH	British Museum (Natural History), London, U.K.
CAS, San Francisco	California Academy of Sciences, San Francisco, California, U.S.A.
IE, Bologna	Istituto di Entomologia del'Università, Bologna, Italy
LACM, Los Angeles	Los Angeles County Museum of Natural History, Los Angeles, California, U.S.A.
MCSN, Genoa	Museo Civico di Storia Naturale 'Giacomo Doria', Genoa, Italy
MCZ, Cambridge	Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MHN, Geneva	Muséum d'Histoire Naturelle, Geneva, Switzerland
NM, Basle	Naturhistorisches Museum, Basle, Switzerland
NM, Vienna	Naturhistorisches Museum, Vienna, Austria
UM, Oxford	University Museum, Oxford, U.K.
USNM, Washington	United States National Museum, Washington, D.C., U.S.A.

Diagnosis of *Tetramorium*

TETRAMORIUM Mayr

Tetramorium Mayr, 1855 : 423. Type-species: *Formica caespitum* L., 1758 : 581, by subsequent designation of Girard, 1879 : 1016.

Xiphomyrmex Forel, 1887 : 385 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Xiphomyrmex*) *kelleri* Forel, loc. cit.; by subsequent designation of Wheeler, 1911 : 175. [Synonymy by Bolton, 1976 : 359.]

For a full statement of the generic synonymy of *Tetramorium* (=*Tetrogmus* Roger, =*Xiphomyrmex* Forel, =*Atopula* Emery, =*Macromischoides* Wheeler, =*Sulcomyrmex* Kratochvíl, =*Lobomyrmex* Kratochvíl) see Bolton, 1976 : 359–365.

DIAGNOSIS OF WORKER AND FEMALE. Myrmicine ants of the tribe Tetramoriini which have the following combination of characters. Mandibles with 2–3 enlarged apical teeth followed by a row of 4 (rarely more) denticles, so that at least 6 (usually 7) teeth are present altogether. Sting with an apical or apicodorsal translucent lamelliform appendage which may be spatulate, triangular, dentiform or pennant-shaped. Lateral portions of clypeus raised into a sharp ridge or shielding wall in front of the antennal insertions. Palp formula 4, 3 at maximum. (Usually with this count, very rare reductions to 4, 2; 3, 3 and 3, 2 are known.) Antennae with 11 or 12 segments, with an apical club of 3 segments. Body hairs never regularly branched bifid, trifid or quadrifid, usually simple but very rarely absent or bizarre.

DIAGNOSIS OF MALE. Myrmicine ants of the tribe Tetramoriini which have the following combination of characters. Mandibles dentate. Antennae with 10 or 11 segments, the second funicular an elongate fusion-segment; funiculus filiform. Palp formula 4, 3 at maximum as worker/female. Body hairs as worker/female, never regularly branched.

A more complete definition of the genus has been given previously (Bolton, 1976), along with a discussion of the genus-level synonymy of *Tetramorium*. An abridged version of this synonymy is noted above as in both the regions at present under consideration some species occur to which the generic name *Xiphomyrmex* was formerly applied. During the first part of this study it was found that this name, based only on the reduced antennomere count of 11 in worker and female castes (as opposed to 12), had no significance as it occurred in a number of widely divergent groups whilst other characters of generic significance remained fixed throughout those groups and throughout groups in which the antennae had 12 segments. In consequence *Xiphomyrmex* was sunk as a junior synonym of *Tetramorium*.

In the regions now under consideration *Tetramorium* is the only tetramoriine genus with endemic species, although tramp-species of the genus *Triglyphothrix* Forel are known to occur (certainly *Tr. lanuginosa* (Mayr) and very probably *Tr. kheperra* Bolton). These are distinguished from *Tetramorium* by their possession of numerous branched hairs, bifid or trifid, on all surfaces of the body. Finally, the parasitic genus *Anergates* Forel, whose host is *Tetramorium caespitum* (L.), is known from New Jersey, U.S.A., but this is hardly likely to be confused with *Tetramorium* as it lacks a worker caste, has an apterous, pupoidal male and is morphologically very distinct (see Bolton, 1976 and included references).

Species of the Malagasy region

To the present time 36 species of *Tetramorium* have been recorded from the Malagasy region, the majority of them from the island of Madagascar itself. Of these 29 are found only in Madagascar, the remaining seven species representing forms shared with the Ethiopian region only (four species), or tropical or cosmopolitan tramp-species which are also widely distributed elsewhere in the world (three species).

The *Tetramorium* fauna of the Malagasy region has never been reviewed previously and earlier literature on the subject consists only of scattered descriptions of new forms, spanning the years 1887–1926 (for endemic forms), the latter date appearing to be the last word on the subject until the present. The reasons for this are the paucity of more recent collections and the rather poor original descriptions of many of the species, so that later workers found it difficult to relate their material to the published descriptions.

The shortage of material has been rectified to a large extent by Professor W. L. Brown, whose two visits to Madagascar in 1969 and 1977, coupled with the collecting activities of A. Peyrieras, have led to a much better understanding of the fauna. This is reflected in the fact that of the 29 endemic species over half of them are described as new in the present paper.

The endemic species fall into six species-groups and it is interesting to note that in Madagascar, as in Australia, forms with 11-merous antennae greatly outnumber those in which the antennae are 12-merous. Thus, of Madagascar's 29 endemics only 4 species have 12-segmented antennae. (In Australia, of 17 known endemic species only 2 have 12-segmented antennae, and in the New World no endemic forms with 12 segments are known.) In the main range of *Tetramorium*, through the Palaearctic, Ethiopian, Oriental and Indo-Australian regions, the reverse is true: the Palaearctic has no endemic species with 11-merous antennae; the Ethiopian has 22 out of about 150 known species; the Oriental 7 out of 29 and the Indo-Australian 10 out of 46. In the first part of this study (Bolton, 1976) I speculated on the significance of this peripheral predominance of forms with 11-merous antennae and the present part seems to confirm these impressions.

Of the eight species-groups recorded from Madagascar three are peculiar to the region (*tosii*-group, *schaufussi*-group and *ranarum*-group), two are shared only with the Ethiopian region (*weitzeckeri*-group and *sericeiventre*-group) and the remainder are groups with a wide distribution (*tortuosum*-group) or which have one or more very successful tramp species (*simillimum* and *bicarinatum*-groups).

Synonymic list of species

Species shared only with Ethiopian region marked*; tramp species marked†.

schaufussi-group
cognatum sp. n.
naganum sp. n.
proximum sp. n.
schaufussi Forel
nassonowii Forel **syn. n.**
severini (Emery) **comb. n.**
sikorae Forel
latior Santschi **syn. n.**
xanthogaster Santschi **stat. n.**
weitzeckeri-group
bessoni Forel
bessoni var. *orientale* Forel **syn. n.**
dysalum sp. n.
humbloti Forel
marginatum Forel
steinheili Forel
tortuosum-group
andrei Forel
electrum sp. n.
isectum sp. n.
kelleri Forel
latreillei Forel
pleganon sp. n.
robustior Forel **stat. n.**
ranarum-group
coillum sp. n.
degener Santschi
ibycterum sp. n.
plesiarum sp. n.
quasirum sp. n.
ranarum Forel
zenatum sp. n.
tosii-group
tantillum sp. n.
tosii Emery
bicarinatum-group
†***bicarinatum*** (Nylander)
sericeiventre-group
****quadrispinosum*** Emery
blochmanii var. *montanum* Forel **syn. n.**
****sericeiventre*** Emery
blochmannii Forel **syn. n.**
simillimum-group
anodontion sp. n.
†***caldarium*** (Roger) **stat. rev.**
****delagoense*** Forel **stat. n.**
simillimum var. *madecassum* Forel **syn. n.**
†***simillimum*** (F. Smith)
scytalum sp. n.

Key to species (workers)

[All species are restricted to Madagascar except where otherwise stated.]

Note. T. bessoni is keyed out in two places because of variation in pilosity. Hairs are usually present on first gastral tergite but very sparse; in a few individuals they are absent.

1 Antennae with 11 segments 2
– Antennae with 12 segments 28
2 First gastral tergite generally with pubescence (which may be very dense), but without elongate standing hairs such as are seen fringing the remaining segments, or very rarely with a sparse row on the extreme apical margin of the first tergite 3

– First gastral tergite with or without pubescence but always with elongate standing hairs such as are seen fringing the remaining segments, usually arising all over the surface of the tergite, rarely more dense basally than apically 10

3 Dorsal alitrunk mostly or entirely smooth and shining, rugular sculpture either vestigial or absent 4

– Dorsal alitrunk with conspicuous and usually coarse rugular sculpture 6

4 Mandibles smooth and shining with scattered small pits . . . . . ***severini*** (p. 138)

– Mandibles distinctly longitudinally striate 5

5 Dorsum of head between frontal carinae coarsely longitudinally rugulose, the interspaces filled with a dense reticulate-puncturation. Clypeus with a weak median carina and numerous other meandering rugulae. (Ethiopian R.; Comoro Is.). . . . . ***humbloti*** (p. 142)

– Dorsum of head between frontal carinae with a few weak sinuous rugulae or virtually unsculptured, the interspaces mostly shining but with some vestigial surface sculpture. Clypeus with a strong median carina flanked by a lateral pair, the spaces between without numerous meandering rugulae . . . . . ***bessoni*** (part) (p. 141)

6 Mandibles coarsely longitudinally striate . . . . . ***latreillei*** (p. 146)

– Mandibles either smooth with scattered pits or with feeble shagreening 7

7 With alitrunk in profile the propodeal dorsum without hairs or at most with only a single pair of short hairs arising laterad immediately behind the metanotal groove (Figs 2, 6) . . 8

– With alitrunk in profile the propodeal dorsum with numerous fine hairs which arise all over the surface (Figs 7, 26) 9

8 Larger species, HW 0·65–0·75, SL 0·50–0·60. First gastral tergite with sparse minute pubescence which is strongly appressed. Pronotal dorsum with a distinct coarse rugoreticulum ***proximum*** (p. 137)

– Smaller species, HW 0·50–0·60, SL 0·35–0·45. First gastral tergite with dense pubescence which is slightly elevated, not appressed. Pronotal dorsum with fine longitudinal rugulation ***cognatum*** (p. 135)

9 Dorsal surfaces of petiole and postpetiole in profile with fine, standing pilosity (Fig. 7) ***naganum*** (p. 136)

– Dorsal surfaces of petiole and postpetiole in profile without standing pilosity of any form (Fig. 26) . . . . . ***ibycterum*** (p. 148)

10 Promesonotal dorsum completely smooth, without trace of rugular sculpture 11

– Promesonotal dorsum with distinct rugular sculpture 12

11 Promesonotum marginate laterally (Fig. 11). Erect or suberect hairs numerous and conspicuous on promesonotum, petiole, postpetiole and first gastral tergite. Mandibles smooth or at most with only faint traces of sculpture . . . . . ***marginatum*** (p. 142)

– Promesonotum not marginate laterally, the dorsum rounding evenly into the sides (Fig. 9). Erect or suberect hairs inconspicuous, sparse to absent on promesonotum, petiole, postpetiole and first gastral tergite. Mandible coarsely longitudinally striate ***bessoni*** (part) (p. 141)

12 Basal one-third of first gastral tergite densely finely reticulate-punctate . ***pleganon*** (p. 146)

– Basal one-third of first gastral tergite unsculptured except for hair-pits 13

13 Metapleural lobes very reduced, scarcely visible in profile and represented by very shallow, feeble rounded flanges (Fig. 20). Propodeal spines extremely long and somewhat downcurved along their length . . . . . ***electrum*** (p. 144)

– Metapleural lobes prominent, projecting in profile as triangular, dentiform or spiniform structures, rarely truncated apically. Propodeal spines variable in shape and size, but not as above (Figs 4, 13–16, 18, 19, 21, 24, 25, 27) 14

14 Mandibles smooth and shining, without any trace of longitudinal striation or rugulation . 15

– Mandibles longitudinally striate or rugulose, usually conspicuously so but only delicately marked in a few species 18

15 Head and alitrunk dark brown, the pedicel and gaster clear yellow, the two strongly contrasting ***xanthogaster*** (p. 139)

– Head, alitrunk and gaster either concolourous or with the gaster darker, but never bicoloured as above. 16

16 Promesonotum in dorsal view sharply marginate laterally (Fig. 24), almost flat transversely and sculptured with conspicuous strong, longitudinal rugae . . . . ***dysalum*** (p. 141)

– Promesonotum in dorsal view not sharply marginate laterally, the dorsum curving into the sides and transversely convex. Sculpture of promesonotum either reticulate-rugose or irregular. 17

17 Clypeus with a median longitudinal carina. Long hairs on promesonotal dorsum sparse, restricted to a few pairs situated anteriorly and laterally. Smaller species, SL<0·50. (Madagascar, Reunion I.) . . . . . ***sikorae*** (p. 138)

– Clypeus without a median longitudinal carina. Long hairs on promesonotal dorsum numerous, arising all over the surface. Larger species, SL>0·50 . . . . ***schaufussi*** (p. 137)

18 Dorsum of postpetiole smooth, without trace of rugular sculpture 19

– Dorsum of postpetiole with rugular sculpture. 24

19 Antennal scrobes strongly developed; with the head in profile the scrobal area bounded above and below by strong carinae and divided into upper and lower portions by a strong median longitudinal carina (Fig. 27) . . . . . ***plesiarum*** (p. 150)

– Antennal scrobes weakly or not developed, never bounded below by a strong carina nor with a median longitudinal carina dividing the scrobal area into upper and lower portions . 20

20 Node of petiole in dorsal view anteroposteriorly compressed, much broader than long; the dorsum of the node unsculptured . . . . . ***steinheili*** (p. 143)

– Node of petiole in dorsal view as long as broad or slightly longer than broad; the dorsum of the node usually sculptured 21

21 Node of petiole in profile with the posterior face sloping outwards so that the posterodorsal angle overhangs the posterior face (Fig. 19). Dorsum of petiole node in profile flat ***zenatum*** (p. 151)

– Node of petiole in profile with posterior face not modified as above. Dorsum of petiole node in profile convex, if only feebly so 22

22 Rugoreticulum on pronotal dorsum distinctly raised up and sharply defined, the top surfaces of the rugulae sharp and smooth, without a beaded appearance . . . ***degener*** (p. 148)

– Rugoreticulum on pronotal dorsum feebly raised up and blunt, the top surfaces of the rugulae bluntly rounded and with a beaded appearance due to the presence of aligned fine punctulation 23

23 Larger species with relatively slightly smaller eyes, HW>0·65, SL>0·45, maximum diameter of eyes about 0·17–0·19 × HW . . . . . ***ranarum*** (p. 151)

– Smaller species with relatively slightly larger eyes, HW<0·65, SL<0·45, maximum diameter of eyes about 0·20–0·21 × HW . . . . . ***quasirum*** (p. 150)

24 With the petiole node in profile the anterior and dorsal surfaces confluent through a convex curve or extremely obtusely rounded angle, the anterior face of the node much shorter than the posterior so that the dorsum slopes upwards posteriorly (Fig. 13). Longest hairs on hind tibiae and on scapes distinctly longer than the maximum width of the appendage from which they arise . . . . . ***kelleri*** (p. 145)

– With the petiole node in profile the anterior and dorsal surfaces meeting in a sharp angle, the two not confluent (Figs 14, 16, 18, 21); anterior and posterior faces of node of approximately equal length. Longest hairs on hind tibiae and scapes much shorter than the maximum width of the appendage from which they arise 25

25 Smaller species, HW<0·70, SL<0·50 . . . . . ***coillum*** (p. 147)

– Larger species, HW>0·80, SL>0·60 26

26 Eyes very small (maximum diameter 0·14 at HW 0·92), the maximum diameter of the eye 0·15 × HW . . . . . ***isectum*** (p. 145)

– Eyes larger, the maximum diameter of the eye always greater than 0·20 × HW 27

27 Somewhat smaller, more slenderly built species, HW<0·95 (usually <0·90), with relatively longer antennal scapes, SI>85 . . . . . ***andrei*** (p. 143)

– Somewhat larger, more stockily built species, HW>0·98 (usually >1·00), with relatively shorter antennal scapes, SI<80 . . . . . ***robustior*** (p. 147)

28 Propodeum completely unarmed (Fig. 23) . . . . . ***anodontion*** (p. 156)

– Propodeum armed with a pair of spines or teeth 29

29 Anterior clypeal margin with a distinct median notch or impression (Fig. 47). (Cosmopolitan tramp species) . . . . . ***bicarinatum*** (p. 164)

– Anterior clypeal margin entire, without a median notch or impression 30

30 Large species, HW>0·70 (usually >0·80) 31

– Small to minute species, HW<0·60 34

31 Propodeal dorsum without hairs of any description (Fig. 35) 32

– Propodeal dorsum with erect or suberect fine hairs (Fig. 33) 33

32 Sculpture of dorsal alitrunk and head strong, consisting of longitudinal rugae and a dense reticulate-puncturation which blankets the entire surface. First gastral tergite usually

completely sculptured, matt and dull. (Very common in Ethiopian region) ***sericeiventre*** (p. 155)

– Sculpture of dorsal alitrunk and head feeble or absent, sometimes with a few very weak rugulae, more usually with just a superficial punctulation. First gastral tergite either unsculptured or at most with a superficial reticulation, shining. (Widespread in southern Africa) ***quadrispinosum*** (p. 155)

33 Antennal scapes both relatively and absolutely longer, SI 98, SL 0·96. Eyes very strongly prominent (Fig. 32) . . . . . ***tosii*** (p. 153)

– Antennal scapes both relatively and absolutely shorter, SI<85, SL<0·80. Eyes not strongly prominent (Fig. 30) . . . . . ***tantillum*** (p. 152)

34 Mandible usually smooth and shining, unsculptured except for scattered pits. If faint traces of sculpture present then petiole node in profile relatively low and broad (Fig. 29). (Aldabra, Madagascar) . . . . . ***scytalum*** (p. 157)

– Mandibles sculptured and dull, either finely striate or finely shagreened, rarely with sculpture feeble in which case petiole node in profile relatively high and narrow (Fig. 28) . . 35

35 With the head in full-face view the sides immediately behind the eyes with an anteriorly directed stout, blunt hair projecting outwards at an angle of approximately 45°. (Very widespread in Ethiopian region) . . . . . ***delagoense*** (p. 156)

– With the head in full-face view the sides behind the eyes without such a projecting stout hair 36

36 Frontal carinae strongly developed throughout their length, sinuate, running unbroken almost to the occipital margin and surmounted throughout their length by a narrow raised rim or flange. The whole of the frontal carinae much more strongly developed than the remaining cephalic rugulae. Ground sculpture of head between frontal carinae strongly granular or reticulate-punctulate, the surfaces matt. Antennal scrobes shallow but broad and conspicuous (Fig. 41). (Cosmopolitan tramp species) . . . . . ***simillimum*** (p. 170)

– Frontal carinae feebly developed, weakly or not sinuate, most strongly developed to level of midlength of eye behind which they become very weak or broken, or gradually fade out posteriorly; not surmounted by a raised rim or flange beyond the level of the midlength of the eye, behind which the carinae are no stronger than the remaining cephalic rugulae. Ground sculpture of head more feeble than above, the surfaces dully shining. Antennal scrobes vestigial (Fig. 42). (Tramp species mostly in tropics and subtropics) ***caldarium*** (p. 169)

The *schaufussi*-group

Antennae with 11 segments, sting appendage spatulate. Mandibles smooth and highly polished, unsculptured except for scattered pits. Clypeus with a median notch or impression in the anterior margin. Petiole nodiform, without sharp angles, all sides of the node rounding into the dorsum through curves or very blunted angles, not separated by acute angles or edges. Postpetiole low nodiform, rounded dorsally. Both segments of pedicel unsculptured, smooth and shining.

This small group of seven species is restricted to the Malagasy region, but its closest relatives appear to belong to the *grassii*-group of South Africa, despite the fact that the antennae have 12 segments in that group.

Within the Malagasy region the species of the *schaufussi*-group fall neatly into two complexes of related forms. The first of these, containing the species *cognatum*, *naganum*, *proximum* and *severini*, is characterized by a complete lack of pilosity on the first gastral tergite and generally also by a reduction in pilosity on the pedicel segments and propodeum (not in *naganum*). These species are discussed under *cognatum*. The second group includes *schaufussi*, *sikorae* and *xanthogaster*, in which pilosity is distributed all over the first gastral tergite (in a few individuals the pilosity may be more dense basally than apically), and these forms are discussed under *schaufussi*.

Tetramorium cognatum sp. n.
(Figs 1, 2)

HOLOTYPE WORKER. TL 2·8, HL 0·66, HW 0·56, CI 85, SL 0·42, SI 75, PW 0·44, AL 0·78.

Mandibles smooth, with scattered small pits. Anterior margin of clypeus with a shallow median impression, the clypeus with a pair of lateral carinae which are at least as strongly developed as the median. Frontal carinae extended back on head by a pair of weak ridges which are almost parallel, very slightly

sinuate. Antennal scrobes feeble, scarcely impressed but as long as the scapes, the latter short. Corners of pronotum in dorsal view angular. Metanotal groove feebly impressed with the alitrunk in profile. Propodeum armed with a pair of short triangular spines, the metapleural lobes triangular and larger than the propodeal spines (in some specimens the two are subequal). Node of petiole high and narrow, rounded, in dorsal view slightly broader than long. Dorsum of head and promesonotum finely longitudinally rugulose, the rugulae irregular and tending to meander slightly, the spaces between the rugulae with a fine superficial sculpture of small punctures. Pedicel and gaster unsculptured. Dorsum of head and alitrunk with sparse pubescence and with a number of long, erect hairs (variable on propodeum, usually hairless but some with a single short pair laterad, immediately behind the metanotal groove). First gastral tergite with long and quite dense pubescence but without long hairs such as are seen on the head, alitrunk, and fringing the remaining gastral tergites. Colour mid-brown, the gaster slightly darker.

PARATYPE WORKERS. As holotype but some more lightly and others more darkly coloured. The petiole node shows some variation and may be as broad as long in dorsal view. The range of dimensions noted is TL 2·5–2·8, HL 0·60–0·66, HW 0·54–0·58, CI 85–91, SL 0·36–0·42, SI 70–75, PW 0·40–0·44, AL 0·70–0·78 (10 measured).

Holotype worker, **Madagascar**: Périnet & vic., rain for. rot. wd., 19.iii.1969, rain forest (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 11 workers with same data as holotype; 5 workers and 2 females with same data as holotype but 17.iii.1969; 2 workers with same data as holotype but 18.iii.1969 (MCZ, Cambridge; BMNH; MHN, Geneva; NM, Basle).

In the *schaufussi*-group the *cognatum*-complex of species is characterized by the lack of pilosity on the first gastral tergite but its retention on succeeding segments. In this complex are *severini*, *proximum*, *cognatum* and *naganum*. Of these *severini* is the most conspicuous, being larger than the rest (compare measurements) and having very reduced sculpture on the dorsal alitrunk. The other three species are distinctly smaller and the dorsal alitrunk is strongly rugulose or reticulate-rugulose. *T. naganum* is distinguished by having numerous fine hairs on propodeum and pedicel segments which are absent in the other three members of this complex, although a single pair of fine short hairs is developed laterad immediately behind the metanotal groove in some samples of *cognatum*. Finally, *cognatum* is separated from *proximum* by the presence in the latter of dense short pubescence on the first gastral tergite which is slightly elevated, whilst in the former pubescence is minute, very sparse and strongly appressed.

It is interesting to note that *ibycterum* of the *ranarum*-group and *latreillei* of the *tortuosum*-group have paralleled the members of this complex in losing the pilosity of the first gastral tergite, though what advantage is gained by suppressing the gastral hairs cannot be guessed at.

NON-PARATYPIC MATERIAL

Madagascar: no loc. (*Staudinger*); vic. Andasibé (=Périnet) (*W. L. & D. E. Brown*); Parc. Nat. Mont. d'Ambre (*W. L. & D. E. Brown*); La Mandraka (*W. L. & D. E. Brown*).

Tetramorium naganum sp. n.
(Fig. 7)

HOLOTYPE WORKER. TL 2·8, HL 0·70, HW 0·66, CI 94, SL 0·48, SI 73, PW 0·48, AL 0·78.

Mandibles smooth with scattered pits, without longitudinal striation. Anterior clypeal margin with a median notch or impression. Frontal carinae moderately well developed, extending back almost to the occiput, but becoming confused with the remaining cephalic sculpture before reaching it. Antennal scrobes broad and shallow, without delimited ventral or posterior margins. In full-face view the occipital margin broadly concave, the sides of the head evenly convex and the head narrower in front of the eyes than behind. Dorsal alitrunk in profile evenly convex, the propodeum armed with a pair of straight narrow spines. Metapleural lobes triangular and acute. Node of petiole high and narrow, shaped as in Fig. 7; in dorsal view subglobular, very slightly broader than long. Dorsum of head irregularly longitudinally rugulose, the rugulae fine and widely separated and the interspaces with distinct granular or punctulate ground-sculpture. Dorsal alitrunk covered with irregular fine rugulae which form a disorganized and very broken reticulum, the spaces between them with feeble ground-sculpture which is weaker than on the head. Petiole, postpetiole and gaster unsculptured. Dorsal surfaces of head, alitrunk, petiole and postpetiole with numerous erect fine long hairs and also with scattered pubescence, also erect or

suberect. First gastral tergite with abundant subdecumbent pubescence, but without long hairs such as are obvious on the dorsal alitrunk and fringing the remaining gastral segments. Colour orange-brown.

PARATYPE WORKERS. TL 2·8–2·9, HL 0·68–0·70, HW 0·62–0·66, CI 90–94, SL 0·46–0·50, SI 73–78, PW 0·47–0·50, AL 0·70–0·78 (11 measured). As holotype.

Holotype worker, **Madagascar**: La Mandraka, 1280 m, 8.ii.1977, leaf litter, mont. forest, AB 41 nest in seed capsule in litter (*W. L. & D. E. Brown*) (MCZ, Cambridge).

Paratypes. 16 workers and 1 dealate female, with same data as holotype (MCZ, Cambridge; BMNH).

Among the species of the *schaufussi*-group which lack long hairs on the first gastral tergite, *naganum* is unique in having fine long hairs present on the propodeum, petiole and postpetiole. As in *cognatum*, pubescence on the first gastral tergite is dense and somewhat elevated, not minute, scattered and appressed as in *proximum*.

Tetramorium proximum sp. n.
(Figs 5, 6)

HOLOTYPE WORKER. TL 3·5, HL 0·82, HW 0·72, CI 88, SL 0·58, SI 80, PW 0·56, AL 1·02.

Mandibles smooth with scattered small pits. Clypeus with a distinct median notch or impression and developed median carina. Frontal carinae strong, extending back well behind the posterior margins of the eyes, the two carinae nearly parallel, only slightly divergent posteriorly. Scrobes shallow but well differentiated, capable of containing the scape. Pronotal corners angulate in dorsal view. Metanotal groove a broad, shallow impression; propodeal spines quite short, stout and acute, the metapleural lobes broadly triangular, almost but not quite as long as the propodeal spines. Node of petiole in profile high, narrow, the anterior and posterior faces more or less parallel, the dorsum convex (Fig. 6). In dorsal view the outline of the node almost circular, only a very little broader than long. Dorsum of head longitudinally rugose, the dorsal alitrunk with a strong rugoreticulum. Pedicel and gaster unsculptured, completely smooth, shining. Dorsum of head and promesonotum with a number of erect to suberect fine long hairs, the propodeum, pedicel and first gastral tergite without hairs but the last with sparse fine, very short, appressed pubescence. Remaining gastral tergites with long hairs as on promesonotum. Colour light brown, shiny.

PARATYPE WORKERS. As holotype but varying in colour from light to quite dark brown, the most deeply coloured specimens with a reddish tinge on the alitrunk. Dimensions in range TL 3·2–3·5, HL 0·76–0·82, HW 0·64–0·70, CI 82–89, SL 0·54–0·58, SI 80–85, PW 0·48–0·56, AL 0·92–1·00 (10 measured).

Holotype worker, **Madagascar**: Périnet & vic., rain for. rot. wd., 18.iii.1969 (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 10 workers and 1 female, same data as holotype (MCZ, Cambridge; BMNH).

This is one of the four species constituting the *cognatum* complex within the *schaufussi*-group, and as such lacks pilosity on the first gastral tergite. The separation of *proximum* is dealt with under the discussion of *cognatum*, but it can be noted here that good diagnostic characters of *proximum* within its species-group include absence of pilosity on propodeum, pedicel and first tergite coupled with a distinct rugoreticulum on the promesonotum and very dilute short gastral pubescence which is appressed.

NON-PARATYPIC MATERIAL

Madagascar: no loc. (*Staudinger*); 2 specimens without data in Forel Coll. (MHN, Geneva); Parc Nat. Mont. d'Ambre (*W. L. & D. E. Brown*); vic. Andasibé (=Périnet) (*W. L. & D. E. Brown*).

Tetramorium schaufussi Forel

Tetramorium (*Xiphomyrmex*) *schaufussi* Forel, 1891*a*: 158. Holotype worker, MADAGASCAR: central province (*C. Schaufuss*) (MHN, Geneva) [examined].

Tetramorium (*Xiphomyrmex*) *nassonowii* Forel, 1892: 521. Syntype workers, MADAGASCAR: Forêt d'Andrangoloaka (*Sikora*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 3·3–4·0, HL 0·78–0·98, HW 0·70–0·86, CI 87–90, SL 0·54–0·64, SI 73–77, PW 0·52–0·66, AL 0·98–1·10 (7 measured).

Mandibles smooth with scattered small pits. Median clypeal carina poorly developed or absent. If the former then the carina is no stronger than the remaining clypeal sculpture and cannot be distinguished from it. Frontal carinae extended back behind level of eyes but only weakly developed, the scrobes broad, shallow and poorly defined. Propodeal spines short, triangular, usually shorter than the broadly triangular metapleural lobes, more rarely about as long as the lobes. Head with fine longitudinal rugulae dorsally, the dorsal alitrunk predominantly longitudinally rugose but with some reticulation usually on the anterior pronotum and the propodeum. Pedicel and gaster unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous fine hairs, erect to suberect.

T. schaufussi and *sikorae* form a close species-pair within the *schaufussi*-group and in general have a very similar appearance. They both belong to the *sikorae*-complex of species, characterized by the presence of hairs on the first gastral tergite, and this complex also includes *xanthogaster* which is easily separated (see under *sikorae*). *T. sikorae* and *schaufussi* are best separated by their pilosity as on the dorsal promesonotum pilosity in *sikorae* is sparse, restricted to some 2–3 pairs (rarely 4) situated on the margins anteriorly and laterally, whereas in *schaufussi* the promesonotum has numerous hairs which arise all over the surface.

MATERIAL EXAMINED

Madagascar: no loc. (*Staudinger*); no. loc (*Sikora*).

Tetramorium severini (Emery) **comb. n.**

(Fig. 8)

Xiphomyrmex severini Emery, 1895*b* : 343. Syntype workers, MADAGASCAR: Diego-Suarez, 1893 (*C. Alluaud*) (MCSN, Genoa; MHN, Geneva) [examined].

WORKER. TL 4·5, HL 1·06, HW 0·94, CI 89, SL 0·76, SI 81, PW 0·72, AL 1·30.

Mandibles smooth with scattered small pits. Anterior clypeal margin with a distinct median indentation, the median clypeal carina strongly developed. Frontal carinae long and strong, the extensions forming the upper border of the scrobe which is capable of holding the scape. Metanotal groove distinct with alitrunk in profile. Propodeal spines long and acute, the metapleural lobes low and rounded. Dorsum of head with spaced-out longitudinal rugae which tend to peter out as they approach the occipital margin, the spaces between the rugae with some fine, superficial puncturation. Dorsal alitrunk mostly unsculptured and shining, with scattered, very faint, low rugulae which are almost completely effaced. Pedicel and gaster unsculptured, smooth and shining. Dorsal surfaces of head and alitrunk with scattered fine, elongate hairs, which are also present on the gastral tergites behind the first; pedicel and first gastral tergite without hairs. Colour black or blackish brown, uniform or with the gaster slightly lighter in shade than the alitrunk.

In his original description Emery was of the opinion that this species was related to *andrei* and *latreillei* but this has proved not to be the case as in both those species the mandibles are striate and the petiole nodes angular and sculptured, whereas in *severini* the mandibles are smooth and the petiole node is rounded and unsculptured, showing that the true affinities of *severini* lie with the members of the *schaufussi*-group and particularly with the small complex of species related to *cognatum* in which gastral pilosity is lost from the first tergite. The four species included in this complex are discussed under *cognatum*.

Tetramorium sikorae Forel

Tetramorium (*Xiphomyrmex*) *sikorae* Forel, 1892 : 522. Syntype workers, MADAGASCAR: Amparafaravantsiv (*Sikora*) (MHN, Geneva) [examined].

Xiphomyrmex latior Santschi, 1926 : 243. Syntype workers, MADAGASCAR: Fananantsoa [=Fianorantsoa on data label] (*Descarpentries*) (NM, Basle) [examined]. **Syn. n.**

WORKER. TL 2·7–3·2, HL 0·64–0·70, HW 0·54–0·60, CI 84–91, SL 0·40–0·46, SI 71–80, PW 0·42–0·48, AL 0·74–0·88 (5 measured).

Mandibles smooth with scattered small pits, median clypeal carina distinct. Frontal carinae extended back well beyond the level of the eyes, almost parallel and forming the upper margins of a shallow scrobe which is capable of accommodating the scape. With the alitrunk in profile the metanotal groove shallowly impressed. Propodeum armed with a pair of short, triangular teeth which are shorter than the broadly triangular metapleural lobes. Dorsum of head with very fine longitudinal rugulae and a distinct interrugal sculpture of fine but conspicuous superficial puncturation. Dorsal alitrunk finely rugulose, the pedicel and gaster unsculptured, smooth and shining. Erect or suberect long, fine hairs present on all dorsal surfaces of the body but may be absent from the pedicel segments. Colour yellow-brown.

A small and quite distinctive species, *sikorae* has nevertheless been confused with the *cognatum* complex in the past. The best character for separating them lies in the fact that *sikorae* has numerous erect or suberect hairs on the first gastral tergite; such hairs being absent in *cognatum* and its allies.

Within the *schaufussi*-group, *sikorae* forms the central species of what may be loosely termed the *sikorae*-complex, including the close pair of *sikorae* and *schaufussi*, and the rather more distantly related *xanthogaster*, all of them possessing, within the *schaufussi*-group, hairs on the first gastral tergite. In *xanthogaster* the frontal carinae are feeble, scrobes are absent and the propodeal spines are quite long, besides which the species is bicoloured. The two remaining species are best separated by the characters given under *schaufussi*.

MATERIAL EXAMINED

Madagascar: vic. Andasibé (=Périnet) (*W. L. & D. E. Brown*). **Reunion I.** (ex coll. Mayr).

Tetramorium xanthogaster Santschi **stat. n.**

(Figs 3, 4)

Tetramorium (*Xyphomyrmex*) [sic] *sikorae* st. *xantogaster* [sic] Santschi, 1911: 124. Holotype worker, MADAGASCAR (*J. de Gaulle*) (NM, Basle) [examined].

Xiphomyrmex sikorae subsp. *xanthogaster* Santschi; Wheeler, 1922: 1032. Emery, 1922: 287 [justified emendation].

WORKER. TL 3·2, HL 0·76, HW 0·66, CI 89, SL 0·54, SI 82, PW 0·50, AL 0·88.

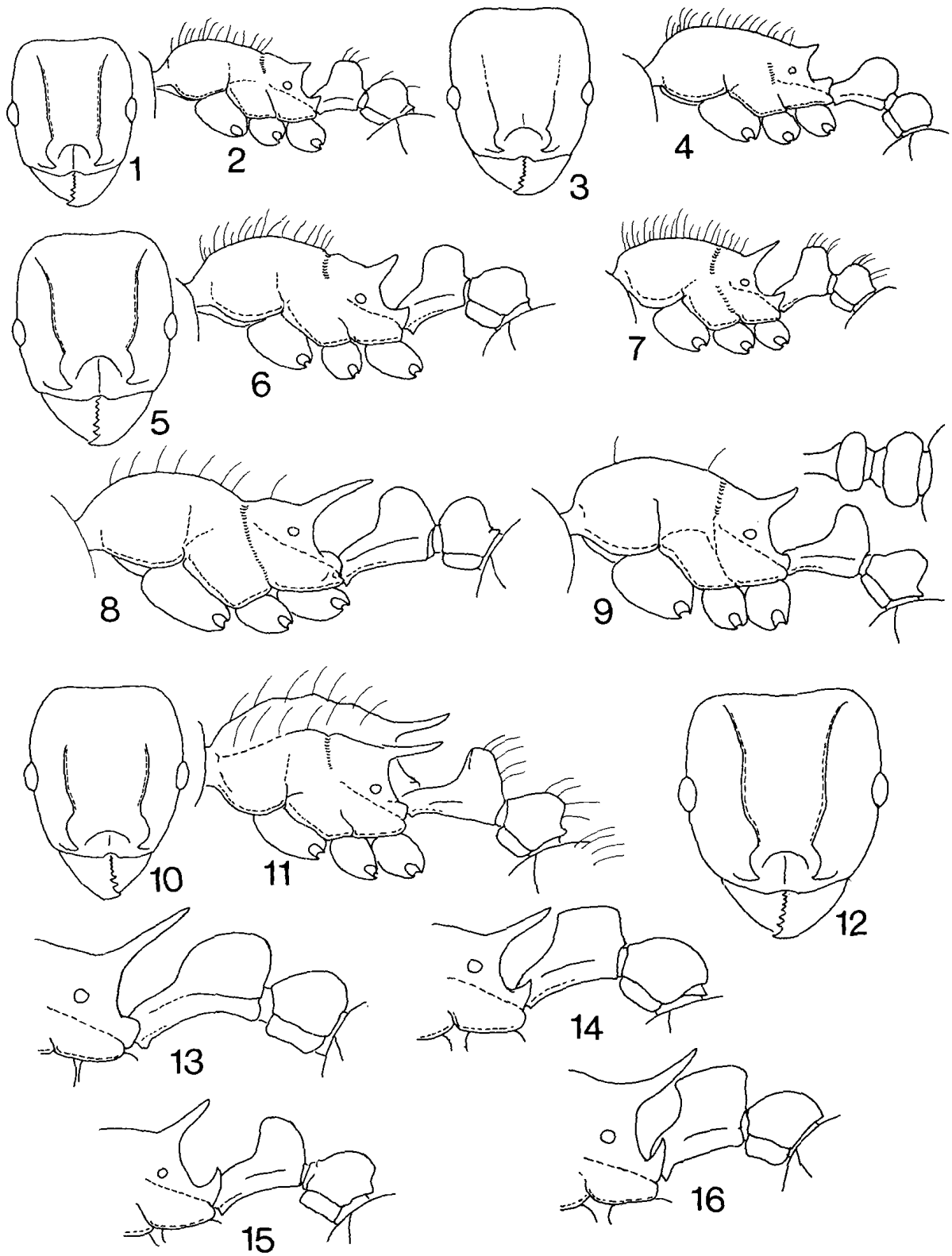
Mandibles smooth with scattered small pits. Median clypeal carina very faint, almost effaced, much less distinct than the lateral carinae. Frontal carinae very reduced, their posterior extensions fine and no more distinct than the rugulae between them. Antennal scrobes absent. Metanotal groove not impressed. Propodeum armed with a pair of short, stout spines, the metapleural lobes roughly triangular. Dorsum of head with very fine, faint, irregular longitudinal rugulae and with a superficial reticulate ground sculpture between them. Dorsal alitrunk with scattered, weak, predominantly longitudinal rugulae. Pedicel and gaster unsculptured, smooth and polished. All dorsal surfaces of head and body with erect or suberect fine hairs. Head and alitrunk dark brown, pedicel and gaster clear pale yellow, the two strongly contrasting.

As Santschi pointed out in the original description, this small species is close to *sikorae*, but unlike that species it is bicoloured, has relatively longer antennal scapes, lacks scrobes and has much better developed propodeal spines. The presence of gastral pilosity places this species in the *sikorae*-complex of the *schaufussi*-group, but the characters given above will quickly separate *xanthogaster* from its allies.

The *weitzeckeri*-group

Antennae with 11 segments, the sting appendage spatulate. Mandibular sculpture varying from strongly longitudinally striate to absolutely smooth. Nodes of petiole and postpetiole unsculptured, at least the petiole tending to be anteroposteriorly compressed, strongly squamiform in some species. More rarely the postpetiole also squamiform.

The *weitzeckeri*-group is the commonest group of species with 11-merous antennae in the Ethiopian region, where about 13 species are present. Four endemic species of this group are known from Madagascar and an African species, *humbloti*, is known from the Comoro Islands but has



Figs 1–16 *Tetramorium* workers. 1–12. Head and/or alitrunk of (1, 2) *cognatum*, (3, 4) *xanthogaster*, (5, 6) *proximum*, (7) *naganum*, (8) *severini*, (9) *bessoni*, (10, 11) *marginatum*, (12) *steinheili*. 13–16. Petiole and postpetiole of (13) *kelleri*, (14) *andrei*, (15) *steinheili*, (16) *robustior*. Pilosity omitted from heads and from Figs 13 to 16.

not yet been recorded from Madagascar proper. These five species fall into two close species-pairs and a solitary, less easily accounted for species. The first pair, *bessoni* and *humbloti*, have the alitrunk rounded transversely above, with very reduced pilosity and sculpture. The second pair, *dysalum* and *marginatum*, have the alitrunk flat transversely above and the sides strongly marginate. The final species, *steinheili*, is a much larger and more robust form which in many respects approaches the *tortuosum*-group.

Tetramorium bessoni Forel

(Fig. 9)

Tetramorium (*Xiphomyrmex*) *bessonii* Forel, 1891*a*: 156, pl. 4, figs 13, 13a. Syntype workers, MADAGASCAR: Pays des Betsileo, Fianarantsoa (*Besson*) (MHN, Geneva) [examined].

Tetramorium (*Xiphomyrmex*) *bessonii* var. *orientale* Forel, 1895*a*: 247. Holotype worker, MADAGASCAR: Imerina oriental (*Sikora*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 4·0–4·2, HL 0·88–0·90, HW 0·82–0·86, CI 90–95, SL 0·60–0·70, SI 74–80, PW 0·62–0·66, AL 1·08–1·14 (6 measured).

Mandibles striate, median clypeal and cephalic carinae well defined and distinct. Frontal carinae strongly developed but antennal scrobes weak. Propodeum armed with a pair of stout spines, the metapleural lobes low and rounded. In profile the petiole strongly antero-posteriorly compressed, thick-squamiform, the node much higher than long. Postpetiole also somewhat compressed. In dorsal view both petiole and postpetiole much broader than long. Clypeus with median and one or two pairs of lateral carinae, the spaces between them feebly or not sculptured. Dorsum of head with median carina and a few widely spaced, weak longitudinal rugulae on each side between median and frontal carinae. These rugulae variable, may be almost completely effaced to quite distinct. Ground-sculpture between the rugulae a very weak, superficial punctulation, again nearly effaced in some individuals. Dorsal alitrunk, pedicel and gaster unsculptured or at most with a few very faint rugulae in the vicinity of the metanotal groove. Erect to suberect hairs present on all dorsal surfaces of head and body but very sparse or (rarely) absent from the first gastral tergite. Colour a uniform medium-brown.

This species is closest related to *humbloti*, an African species which is known to occur on the Comoro Islands but has not yet been reported from Madagascar itself. The two are separated by sculpture, which on the head of *humbloti* is coarse and by the presence in *bessoni* of a number of erect or suberect hairs on the dorsal alitrunk, which is usually completely hairless in *humbloti*.

MATERIAL EXAMINED

Madagascar: La Mandraka (*W. L. & D. E. Brown*); Prov. Diego S., above Sakaramy (*W. L. & D. E. Brown*).

Tetramorium dysalum sp. n.

(Fig. 24)

HOLOTYPE WORKER. TL 3·1, HL 0·72, HW 0·71, CI 99, SL 0·50, SI 70, PW 0·52, AL 0·84.

Mandibles smooth and shining, unsculptured except for minute pits. Anterior clypeal margin with an impression or notch. Frontal carinae strong, surmounted by a narrow raised rim or flange. Alitrunk sharply marginate anteriorly and laterally, the margination of the sides interrupted at the promesonotal junction and more strongly impressed at the metanotal area, between mesonotum and propodeum. Pronotal dorsum transversely flat, the propodeal dorsum transversely feebly concave. Propodeum with a pair of long, acute spines which are slightly downcurved along their length. Metapleural lobes triangular. Node of petiole in profile high and quite narrow, the anterodorsal angle somewhat higher than the posterodorsal so that the slightly convex dorsal surface slopes downwards posteriorly. Dorsum of head regularly longitudinally rugulose, the interspaces with very feeble superficial ground-sculpture. Dorsal alitrunk strongly longitudinally rugose. Petiole and gaster unsculptured but dorsum of postpetiole with very faint traces of superficial sculpture. All dorsal surfaces of head and body with numerous elongate, fine hairs. Colour uniform brown.

PARATYPE WORKERS. TL 2·7–3·1, HL 0·64–0·72, HW 0·60–0·71, CI 95–100, SL 0·43–0·50, SI 68–73, PW 0·46–0·52, AL 0·74–0·84 (15 measured).

As holotype but some specimens slightly darker in shade than the holotype, often the gaster lighter in shade than the alitrunk. The entire type-series apparently represents a single nest-sample, so the normal size variation in this species is fairly large. The degree of curvature of the propodeal spines varies, most specimens being as holotype but a few have them slightly more or slightly less downcurved.

Holotype worker, **Madagascar**: Périnet & vic., rain forest, 17.iii.1969 (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 39 workers and 1 dealate queen with same data as holotype but on some pins the lower label having 'rot. wood' or 'for. litter' (MCZ, Cambridge; BMNH).

NON-PARATYPIC MATERIAL.

Two series collected more recently by W. L. Brown in **Madagascar**: vic. Andasibé (= Périnet), 2–6.ii.77, and **Mangabé I.**: Antongil Bay, 19.ii.77, agree well with the above description but in the Andasibé series body hairs are darker in colour than in the type-series.

This species appears to be close to *marginatum*, but in that species the dorsal alitrunk is unsculptured.

Tetramorium humbloti Forel

Tetramorium (*Xiphomyrmex*) *humbloti* Forel, 1891*a*: 154, pl. 4, fig. 12. Syntype workers, COMORO Is.: Grand Comoro I., Ngasiya (*L. Humblot*) (MHN, Geneva) [examined].

WORKER. TL 3·4–4·1, HL 0·80–0·94, HW 0·74–0·88, CI 92–95, SL 0·56–0·72, SI 74–84, PW 0·54–0·66, AL 0·88–1·08 (30 measured).

Mandibles finely longitudinally striate. Antennal scrobes represented by an impressed area bounded above by the frontal carinae but without a differentiated ventral margin. Alitrunk in profile with the propodeum sloping downwards strongly from the metanotal groove to the base of the stout, acute spines. Metapleural lobes acutely triangular and generally slightly upcurved. Both petiole and postpetiole strongly anteroposteriorly compressed, in profile narrow and much higher than the dorsum is long, in dorsal view markedly transverse, much broader than long, in general form similar to that of *bessoni*, Fig. 9. Head strongly longitudinally rugulose, often with cross-meshes and always with the spaces between the rugulae reticulate-punctate. Dorsal alitrunk unsculptured or at most with some weak punctulation on the pro- or mesonotum. Pedicel segments and gaster unsculptured. Head with sparse, fine, erect hairs. Alitrunk and pedicel usually without hairs but rarely with 2–6 hairs present on the former. First gastral tergite always without hairs, but remaining tergites with them. Colour varying from light to dark brown, the gaster sometimes darker in shade than the alitrunk.

T. humbloti is an African species which has extended its range to include the Comoro Islands, but has not yet been discovered on the mainland of Madagascar. In Madagascar is a sibling of *humbloti*, *T. bessoni*, which has the head consistently less strongly sculptured and also tends to be more densely hairy than *humbloti*. Details for their separation are noted in the key.

As noted above, *humbloti* really belongs to the Ethiopian region fauna, and the description is based mainly upon such material. Discussion of the synonymy and distribution of *humbloti* is not given here as it will be dealt with in the part of this study dealing with the Ethiopian region.

Tetramorium marginatum Forel

(Figs 10, 11)

Tetramorium (*Xiphomyrmex*) *marginatum* Forel, 1895*b*: 485. Syntype workers, MADAGASCAR: central Madagascar (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 3·8–3·9, HL 0·84–0·86, HW 0·78, CI 90–93, SL 0·68–0·70, SI 87–90, PW 0·60, AL 1·00–1·02 (2 measured).

Mandible with a few faint and feeble striae but with extensive smooth areas. Clypeus with a sharp, fine median carina. Frontal carinae short, ending just posterior to the level of the eyes. Antennal scrobes very weak, merely short, shallow impressions below the frontal carinae and not as long as the antennal scapes. Pronotal corners rounded in dorsal view, the sides of the pronotum bluntly marginate. Dorsum of mesonotum and propodeum separated from the sides by an acute, very distinct margination which runs to the bases of the long, acute propodeal spines. Dorsal alitrunk between the margination transversely flat,

longitudinally feebly convex. Metapleural lobes short and rounded. Petiole in profile anteroposteriorly compressed, the node tapering from base to apex as shown in Fig. 11. Dorsum of head with sparse, scattered, fine longitudinal rugulae which peter out posteriorly. Dorsal alitrunk unsculptured but with superficial patterning, the pedicel and gaster unsculptured. All dorsal surfaces of head and body with erect or suberect fine hairs. Head and alitrunk black or blackish brown, the pedicel and gaster dark brown.

Rendered highly conspicuous among the Malagasy tetramoriines by its lack of sculpture, sharply margined mesonotum and propodeum and compressed petiole, *marginatum* is unlikely to be confused with any other member of the genus from Madagascar or Africa.

MATERIAL EXAMINED
Madagascar: Rte d'Anosibé (*W. L. & D. E. Brown*); Beforona (*A. Peyrieras*).

Tetramorium steinheili Forel

(Figs 12, 15)

Tetramorium (*Xiphomyrmex*) *steinheili* Forel, 1892 : 520. Syntype workers, females, MADAGASCAR: Forêt d'Andrangoloaka, confins de l'Imerina (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·3–4·4, HL 1·00, HW 0·94–0·96, CI 94–96, SL 0·72–0·76, SI 77–80, PW 0·68–0·72, AL 1·18–1·20 (2 measured).

Mandibles striate; median clypeal carina sharp. Extensions of frontal carinae long and strong, slightly sinuate from origin to behind the level of the eyes and then strongly divergent, directed towards the occipital corners. Pronotum and mesonotum obtusely marginate at the sides, in dorsal view separated by an impression. Metanotal groove absent, not impressed in profile. Propodeal spines long and stout, metapleural lobes elongate-triangular, acute or blunted apically. Petiole node anteroposteriorly compressed, in dorsal view much broader than long. Dorsum of head regularly longitudinally rugulose, the alitrunk more coarsely rugose, predominantly longitudinal but the rugae meandering and with a few cross-meshes present. Pedicel and gaster unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous fine, erect to suberect hairs. Leading (anterior) edges of antennal scapes with short, projecting, suberect to subdecumbent hairs which are shorter than the maximum width of the scape. Colour reddish brown, the gaster paler than the alitrunk.

In overall appearance *steinheili* resembles some of the members of the *tortuosum*-group, but the unsculptured pedicel segments and the fact that the petiole is distinctly anteroposteriorly compressed seem to indicate that the affinities of *steinheili* are with *humbloti* and its relatives. Despite this I feel that there is a distinct possibility that this species may truly be related to *andrei* and its allies, and convergent upon the *weitzeckeri*-group in pedicel structure.

MATERIAL EXAMINED
Madagascar: Andranobé, Route d'Andriamena (*A. Peyrieras*); Bemanevika, Souspref. Bealanana (*A. Peyrieras*).

The *tortuosum*-group

Antennae with 11 segments, the sting appendage spatulate. Petiole nodiform; one or both pedicel segments with rugose or rugulose sculpture in all Malagasy and New World species. Mandibles sculptured. Large species usually with HW>0·80, rarely less. Legs usually with dense or fairly dense pilosity which is suberect to subdecumbent on the dorsal (outer) surfaces of the middle and hind tibiae.

Within the genus *Tetramorium* this is the largest species-group with 11-merous antennae. The group is represented by about 25 species in the Old World tropics and subtropics, and 7 of these species occur only in Madagascar.

Tetramorium andrei Forel

(Fig. 14)

Tetramorium (*Xiphomyrmex*) *andrei* Forel, 1891*b* : 263. Syntype workers, MADAGASCAR: Bezanozano nr Nosibé, ESE. of Antananarivo (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·3–4·8, HL 1·04–1·08, HW 0·92–0·96, CI 87–90, SL 0·80–0·84, SI 86–89, PW 0·70–0·72, AL 1·30–1·34 (6 measured).

Mandibles striate; median clypeal carina acute. Frontal carinae long and strong, diverging towards the occipital corners behind the level of the eyes but merging into the sculpture before reaching the occipital margin. Antennal scrobes a groove capable of containing the scape. Metanotal groove absent, not impressed in profile. Propodeal spines long and acute, the metapleural lobes short and triangular. Petiole node in profile longer than high, flat-topped or feebly convex dorsally, in dorsal view as long as or longer than broad. Dorsum of head regularly longitudinally rugose; dorsal alitrunk similarly sculptured but with some reticulation towards the sides on the pronotum. Petiole and postpetiole with rugose sculpture which is predominantly longitudinal. Gaster unsculptured except for pits from which hairs arise; these are more conspicuous in some specimens than in others. Dorsal surfaces of head and body all with numerous long, fine, erect to suberect hairs. Leading edges of antennal scape with suberect short, curved hairs. Colour light red-brown.

Of the *tortuosum*-group species on Madagascar *andrei* is most closely related to *robustior*, originally described as an infraspecific variant of *andrei*, and rather more distantly to *latreillei* and *kelleri*. Differences from *robustior* are listed under that species. *T. andrei* is distinguished easily from *latreillei* as the latter lacks hairs on the first gastral tergite and does not have standing hairs on the antennal scapes. *T. kelleri*, on the other hand, has abundant long hairs, the longest on the scapes being much greater than the maximum scapal width. Also, the node shape of the petiole is radically different, compare Figs 13 and 14.

MATERIAL EXAMINED

Madagascar: no loc. (*Staudinger*); no loc. (ex coll. Mayr); Ampasimbé, prov. Tamatave (*J. M. Betsch*).

Tetramorium electrum sp. n.

(Fig. 20)

HOLOTYPE WORKER. TL 4·9, HL 1·14, HW 1·06, CI 93, SL 0·82, SI 77, PW 0·76, AL 1·32.

Mandibles longitudinally striate but only shallowly so, the sculpture reduced in some paratypes. Clypeal margin with a median notch or impression. Frontal carinae long and strong, reaching back almost to the occipital corners and surmounted by a narrow raised rim or flange. Antennal scrobes shallow but broad, the scrobal area above the eye traversed by about four widely spaced longitudinal rugulae, the space for accommodation of the scape unsculptured. Maximum diameter of eye about 0·20. Pronotal dorsum in dorsolateral view feebly transversely concave, the remainder of the dorsum more or less flat transversely and marginate laterally so that sides and dorsum meet in a sharp angle. Propodeal spines very long, in profile downcurved along their length. Metapleural lobes reduced to low, rounded vestiges (Fig. 20), not at all triangular and scarcely prominent in profile. Petiole with a long peduncle and relatively high node (Fig. 20), in dorsal view very slightly longer than broad. Dorsum of head with spaced-out longitudinal rugulae, many of which are discontinuous and which do not form a reticulum occipitally. Spaces between rugulae with slight, very faint ground-sculpture, extensively shining. Dorsal alitrunk centrally with a series of parallel, strong longitudinal rugae which run from anterior pronotum to propodeum. Outside of these are a few disorganized longitudinal rugae and close to the margins there is a tendency for a rugoreticulum to form. Dorsal surfaces of both petiole and postpetiole with faint traces of weak rugulation, which is stronger on the sides; gaster unsculptured. All dorsal surfaces of head and body with numerous fine, acute hairs. Colour dark brown.

PARATYPE WORKERS. TL 4·7–5·2, HL 1·04–1·20, HW 0·96–1·16, CI 92–96, SL 0·74–0·86, SI 72–78, PW 0·72–0·82, AL 1·24–1·40 (11 measured). Maximum diameter of eye *c.* 0·20 (about 0·17–0·19 × HW). As holotype but some specimens darker in colour, blackish brown, and a few with the mandibular sculpture reduced and quite faint.

Holotype worker, **Madagascar**: Rte d'Anosibé, km33, 4–12.iv.1975 forest humus and litter, AB 44 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. **Madagascar**: 11 workers with same data as holotype (MCZ, Cambridge; BMNH); one worker, vic. Andasibé (=Périnet) 950–980 m, 2–6.ii.1977 (*W. L. & D. E. Brown*) (MCZ, Cambridge).

The exceptionally long, downcurved propodeal spines, reduced metapleural lobes and large size will differentiate *electrum* from all members of its group. The only other species of the group in

which the metapleural lobes are reduced is *kelleri*, but here they are still prominent and the node is very differently constructed (compare Figs 13 and 20).

Tetramorium isectum sp. n.

(Figs 17, 18)

HOLOTYPE WORKER. TL 4·1, HL 0·96, HW 0·92, CI 96, SL 0·72, SI 78, PW 0·68, AL 1·12.

Mandibles strongly longitudinally striate, anterior clypeal margin with a distinct median impression. Eyes small, maximum diameter 0·14, about 0·15 × HW. Frontal carinae long and strong, running back to the occipital corner in full-face view and surmounted throughout their length by a narrow raised rim or flange. Antennal scrobes shallow and feeble, the sides of the head above the eye regularly longitudinally rugulose. Occipital margin of head markedly concave in full-face view, the sides shallowly but evenly convex. Pronotal dorsum transversely concave, the mesonotum and propodeum more or less flat. Anterior pronotal angles rounded in dorsal view. Propodeal spines elongate and narrow, elevated and feebly upcurved along their length. Metapleural lobes elongate triangular and acute. Shape of petiole as in Fig. 18, in dorsal view longer than broad and broader behind than in front. Clypeus with three longitudinal carinae. Dorsum of head strongly and regularly longitudinally rugose, the spaces between them with very faint superficial punctulation and with about 8 strong rugae between the frontal carinae at eye-level. Cross-meshes or anastomoses absent except laterally on the occiput. Dorsal alitrunk with very strongly raised longitudinal rugae, the five central ones of which run from pronotum to propodeum (the middle three most strongly defined). Outside these on the pronotum some rugoreticulum is present around the anterior angles, but this is absent elsewhere on the dorsal alitrunk. Dorsal surfaces of petiole and postpetiole rugulose, gaster unsculptured. All dorsal surfaces of body with abundant fine pilosity. Colour bright orange-brown.

Holotype worker, **Madagascar**: Beforona, 500 m, Sept. 1974, forest humus and litter (*A. Peyrieras*) (MCZ, Cambridge).

T. isectum is closest related to *andrei* and *robustior*, but the combination of small eyes, bright orange-brown colour, concave pronotum and very sharply defined longitudinal sculpture easily isolates this species.

Tetramorium kelleri Forel

(Fig. 13)

Tetramorium (*Xiphomyrmex*) *kelleri* Forel, 1887 : 385. Syntype workers, MADAGASCAR: nr Tamatavé, bois de l'Ivondro (*C. Keller*) (MHN, Geneva; BMNH; MCZ, Cambridge; USNM, Washington) [examined].

WORKER. TL 4·9–5·3, HL 1·06–1·16, HW 0·90–0·98, CI 83–86, SL 0·84–0·94, SI 93–97, PW 0·72–0·82, AL 1·34–1·42 (8 measured).

Mandibles striate, median clypeal carina distinct. Frontal carinae strong, extended back nearly to the occipital margin and only very feebly curved so that they are roughly parallel throughout their length. Antennal scrobe a well-marked groove capable of holding the scape. Pronotal corners rounded in dorsal view. Metanotal groove absent to very weakly marked with the alitrunk in profile. Propodeal spines long and acute, the metapleural lobes low and rounded. Petiole in profile with the anterior and dorsal surfaces confluent through a broad curve or an extremely obtuse angle, the dorsum ascending posteriorly so that the anterior face of the node is distinctly shorter than the posterior. In dorsal view the petiole node much longer than broad. Head and dorsal alitrunk reticulate-rugose, the dorsal surfaces of the pedicel also rugose but here the rugae are longitudinal and are more strongly developed on the petiole than on the postpetiole. Gaster unsculptured. All dorsal surfaces of head and body with dense, long, fine hairs which are erect or suberect, and some of which are very long. Antennal scapes and legs also with abundant long, erect hairs, the longest on the scapes being almost or quite twice as long as the maximum scape width. Colour orange-brown.

Probably the most distinctive species of its group in the Malagasy region, the combination of large size, light colour, extreme hairiness and characteristic node shape makes *kelleri* immediately

recognizable. Its nearest relatives do not appear to be any of the Malagasy species but rather it is closest related to *pilosum* Emery and *yerburyi* Forel of the Oriental region.

Tetramorium latreillei Forel

Tetramorium (*Xiphomyrmex*) *latreillei* Forel, 1895*a*: 247. Syntype workers, MADAGASCAR: Imerina oriental (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·7–5·1, HL 1·14–1·20, HW 1·04–1·12, CI 91–93, SL 0·90–0·94, SI 82–86, PW 0·74–0·80, AL 1·38–1·46 (4 measured).

Mandibles striate, median clypeal carina present. Frontal carinae long and strong, divergent throughout their length and directed towards the occipital corners posteriorly. Antennal scrobe a well-defined groove capable of holding the scape. Posteromedian portion of head, in front of the occipital margin, impressed, transversely concave. Metanotal groove absent. Propodeal spines long and strong, metapleural lobes low and rounded. Petiole node in profile subrectangular, with vertical and nearly parallel anterior and posterior faces and a feebly convex dorsum. Head, alitrunk and pedicel regularly longitudinally rugose, the pedicel segments more weakly so than the head and alitrunk, the petiole sometimes with a smooth mediodorsal strip. Erect hairs sparse, present only upon the head and pronotum, apparently not developed on mesonotum, propodeum or pedicel. First gastral tergite with fine greyish appressed pubescence but without hairs, the remaining tergites with hairs. Colour uniform dark brown to black.

In the Malagasy fauna a total of 8 species are now known in which the first gastral tergite lacks hairs. Four of these belong to the *schaufussi*-group, one to the *ranarum*-group and two to the *weitzeckeri*-group. *T. latreillei* is so far the only member of the *tortuosum*-group in which this character occurs, and it serves to separate easily this species from its close relatives.

MATERIAL EXAMINED

Madagascar: no loc. (*Staudinger*); no loc. (*Sikora*).

Tetramorium pleganon sp. n.

HOLOTYPE WORKER. TL 3·8, HL 0·92, HW 0·87, CI 97, SL 0·64, SI 74, PW 0·68, AL 1·10.

Mandibles with very faint, delicate longitudinal striation. Anterior clypeal margin with a very small median impression. Maximum diameter of eye 0·20. Frontal carinae strong, surmounted for most of their length by a narrow rim or flange, occipitally becoming indistinguishable from the surrounding sculpture. Antennal scrobes shallow but broad. Dorsal alitrunk transversely flattened, in dorsolateral view appearing only very weakly convex. Sides of alitrunk bluntly marginate. Propodeal spines elongate and strong, somewhat downcurved along their length. Metapleural lobes short-triangular, acute apically. Node of petiole in profile slightly higher than long, the anterolateral angle roughly a right-angle and the dorsum sloping posteriorly to the much more rounded posterodorsal angle. Postpetiole evenly convex. Dorsum of head regularly longitudinally rugulose, without occipital reticulation; about 11 rugulae between the frontal carinae at the level of the eyes, the spaces between them with very feeble ground-sculpture. Middle of dorsal alitrunk longitudinally rugose, with four roughly parallel strong rugae running from anterior pronotum to propodeum. Outside of these the rugae are more disorganized and meandering, with traces of a broken reticulum in places, especially on the pronotum. Petiole and postpetiole strongly rugose dorsally, the two about equally strongly sculptured. Basal third of first gastral tergite finely and densely reticulate-punctate. All dorsal surfaces of head and body with abundant fine hairs, dorsal surfaces of hind tibiae with suberect to subdecumbent short pilosity. Colour blackish brown, the appendages lighter.

PARATYPE WORKERS. As holotype, but with dimensions TL 3·7–4·0, HL 0·92–0·96, HW 0·88–0·92, CI 96, SL 0·66–0·70, SI 75–76, PW 0·66–0·69, AL 1·10–1·12. Eye diameter 0·18–0·20 (2 measured).

Holotype worker, **Madagascar**: 84 km SW. Sambava on road to Andapa, 70–160 m, 17.ii.1977 degraded for. AB 43, strays on path (*W. L. & D. E. Brown*) (MCZ, Cambridge).

Paratypes. Three workers with same data as holotype (MCZ, Cambridge; BMNH).

This is the only known Malagasy species with 11-merous antennae which has the first gastral tergite sculptured.

Tetramorium robustior Forel **stat. n.**

(Fig. 16)

Tetramorium (*Xiphomyrmex*) *andrei* st. *robustior* Forel, 1892 : 521. Syntype workers, MADAGASCAR: Forêt d'Andrangoloaka (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·6–4·9, HL 1·00–1·04, HW 0·98–1·02, CI 98–100, SL 0·80–0·82, SI 78–80, PW 0·74–0·78, AL 1·30–1·32 (3 measured).

Mandibles striate; median clypeal carina distinct. Frontal carinae strongly developed and sinuate, diverging to the level of the eyes, converging behind the eyes and then diverging again posteriorly, each carina directed towards the occipital corner but merging with the sculpture before reaching it. Antennal scrobe a well-defined groove capable of accommodating the scape. Posteromedian portion of head in front of the occipital margin transversely shallowly concave. Pronotum and mesonotum bluntly marginate laterally. Propodeal spines long and strong, metapleural lobes elongate triangular, dentiform and acute. Petiole node in profile roughly rectangular, slightly broader above than below due to the weak concavity of both the anterior and posterior faces; a second result of this concavity is that the antero- and postero-dorsal angles of the node slightly overhang the faces below them. In dorsal view the node longer than broad. Head regularly longitudinally rugose with a fine but conspicuous punctulation between the rugae. Dorsal surfaces of alitrunk and pedicel more coarsely longitudinally rugose. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine, erect to suberect hairs. Leading edges of antennal scapes with short, suberect curved hairs, which are shorter than the maximum width of the scape.

T. robustior is close to *andrei* but is a more stockily built species with a slightly differently shaped petiole node, relatively broader head and shorter antennal scapes. In view of these differences it is my opinion that *robustior* is best treated as a good species, at least until more material is available and the variation of the two forms is known in more detail.

MATERIAL EXAMINED

Madagascar: no loc. (*Sikora*); Parc Nat. Mont. d'Ambre (*W. L. & D. E. Brown*); Bemanevika, Souspref. Bealanana (*A. Peyrieras*).

The *ranarum*-group

Antennae with 11 segments; sting appendage spatulate. Mandibles sculptured, usually striate, more rarely otherwise. Petiole strongly nodiform, many species in the group with postpetiole unsculptured but the petiole is usually sculptured to some extent. Small species with HW usually <0·80. Dorsal (outer) surfaces of hind tibiae with pubescence which is usually decumbent or appressed, only very rarely otherwise.

This small group of seven species is restricted to the Malagasy region. Their closest relatives appear to be the members of the African *angulinode*-group, but in them the mandibles are always smooth and unsculptured.

Tetramorium coillum **sp. n.**

(Fig. 21)

HOLOTYPE WORKER. TL 2·8, HL 0·72, HW 0·67, CI 93, SL 0·46, SI 69, PW 0·48, AL 0·78.

Mandibles coarsely longitudinally striate, anterior clypeal margin with a distinct notch or impression. Maximum diameter of eye 0·12, about 0·18 × HW. Frontal carinae strong to behind level of eyes, but fading out before they reach the occipital area and becoming confused with the remaining sculpture. Antennal scrobes very feeble, all of the scrobal area sculptured. Propodeal spines strong, feebly upcurved along their length, metapleural lobes triangular and acute. Petiole in profile strongly nodiform, with a sharp anterodorsal angle and with a minute peak at the angle due to the presence of a transverse dorsal carina. Posterodorsal angle of petiole rounded. Node of petiole in dorsal view as broad as long. Dorsum of head finely and irregularly longitudinally rugulose, with a conspicuous punctulate ground-sculpture between them, the rugulae forming a weak reticulum occipitally. Dorsal alitrunk reticulate-rugulose, the sculpture more strongly developed than on the head, the individual rugulae low and rounded, with a beaded appearance dorsally due to the presence of fine aligned punctulation. Spaces between reticular meshes mostly smooth. Petiole dorsum finely and densely rugulose, the postpetiolar dorsum with extensive shining areas but with some rugulae present, especially posterolaterally. Gaster unsculptured. Short, fine acute hairs present on all dorsal surfaces of head and body. Colour dark brown.

PARATYPE WORKERS. As holotype, TL 2·7–2·8, HL 0·66–0·72, HW 0·62–0·66, CI 91–94, SL 0·44–0·47, SI 69–72, PW 0·45–0·47, AL 0·72–0·78. Maximum diameter of eye 0·11–0·12, about 0·17–0·19 × HW.

Holotype worker, **Madagascar**: Bemanevika, Souspref. de Bealanana, 20.x.1975, forest humus and litter, AB 46 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. 12 workers and 2 dealate females with same data as holotype (MCZ, Cambridge; BMNH).

This small species is closest related to *ranarum* and *quasirum* but differs from both of these by retaining rugular sculpture on the postpetiole and by having the anterodorsal angle of the petiole node sharp.

Tetramorium degener Santschi

Tetramorium (*Yphomyrmex*) [sic] *degener* Santschi, 1911 : 124. Holotype worker, MADAGASCAR (*J. de Gaulle*) (NM, Basle) [examined]. [Data label on holotype states: *T.* (*X.*) *ranarum* r. *degener*.]

WORKER. TL 2·1–2·5, HL 0·58–0·60, HW 0·52–0·55, CI 89–93, SL 0·37–0·40, SI 69–74, PW 0·38–0·42, AL 0·60–0·66 (10 measured).

Mandibles longitudinally striate, anterior clypeal margin with a shallow notch or indentation medially which may be difficult to see in some specimens. Frontal carinae distinct to well beyond the level of the eyes but fading out in the posterior quarter of the head-length and becoming indistinguishable from the remaining cephalic sculpture. Antennal scrobes shallow but conspicuous in full-face view, the lower part of the scrobal area with reticular sculpture. Eyes of moderate size, maximum diameter *c.* 0·12, about 0·22 × HW. Propodeum with a pair of stout triangular spines, the metapleural lobes triangular and acute. Node of petiole in profile higher than the dorsum is long, with roughly parallel anterior and posterior faces and a feebly convex dorsum. In dorsal view the petiole node very slightly broader than long. Postpetiole evenly convex in profile. Head with fine longitudinal rugulation dorsally, which becomes reticulate occipitally. Interspaces with a very feeble superficial punctulation. Dorsal alitrunk reticulate-rugulose, best developed on the pronotum, the rugulae fine and sharply defined, not having a beaded appearance dorsally.

Postpetiole and gaster always unsculptured but the petiole dorsum often with traces of sculpture present. All dorsal surfaces of head and body with numerous fine hairs, mainly erect or suberect. Colour uniform light brown, the appendages lighter.

T. degener is a small species characterized by its moderately sized eyes and sharply defined sculpture. It is closest related to *quasirum*, a similar-sized species, but here the sculpture of the dorsal alitrunk is low and blunted, the upper surface with a beaded appearance due to the presence of fine aligned punctulation. Similar sculpture is present on the pronotum of *coillum* and *ranarum*, but this latter species averages larger and has relatively small eyes, and the former retains traces of rugulose sculpture on the postpetiole.

MATERIAL EXAMINED

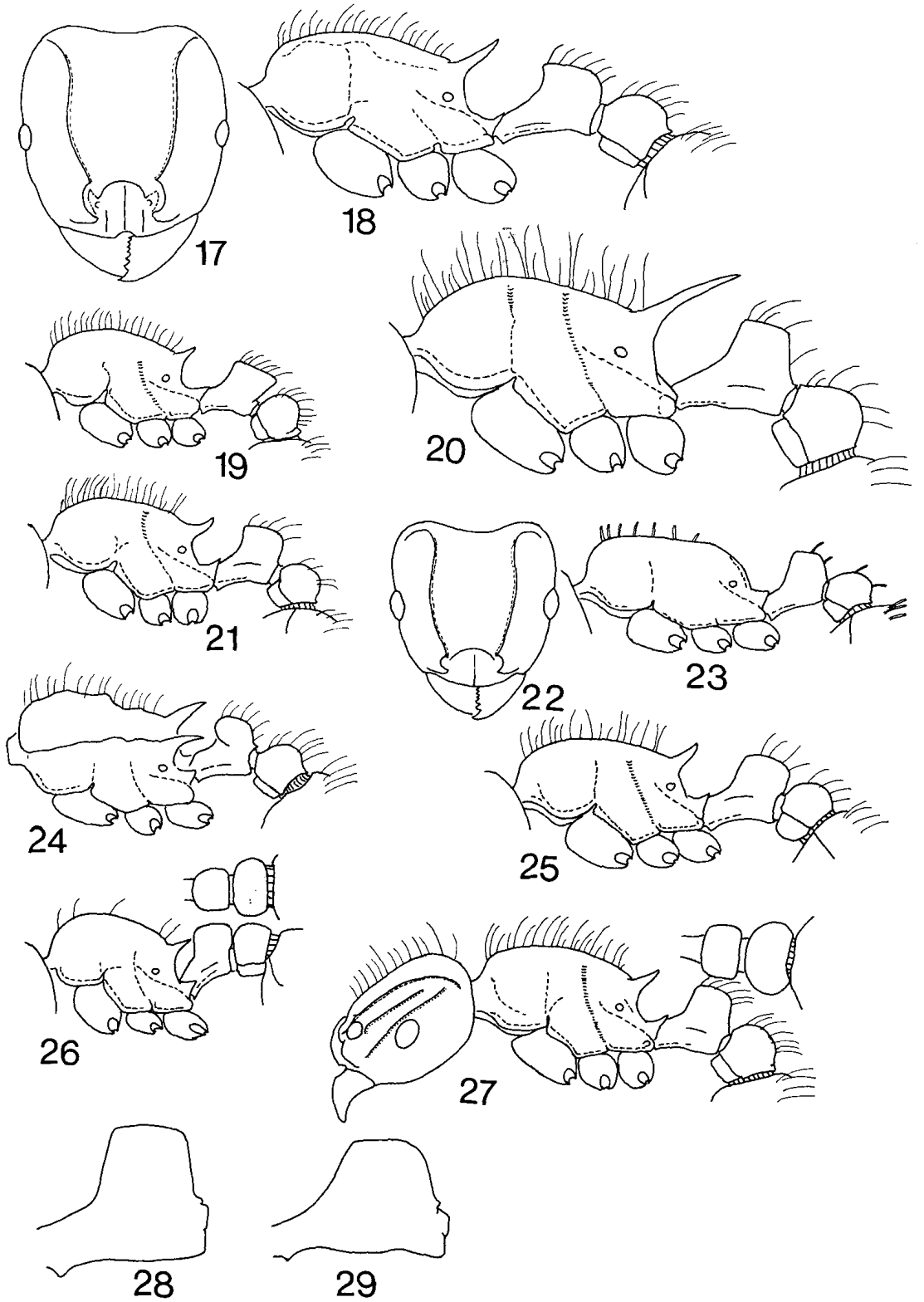
Madagascar: Périnet (*W. L. Brown*).

Tetramorium ibycterum sp. n.

(Fig. 26)

HOLOTYPE WORKER. TL 2·5, HL 0·64, HW 0·61, CI 95, SL 0·43, SI 70, PW 0·44, AL 0·68.

Mandibles with delicate sculpture resembling feeble shagreening, not longitudinally striate. Anterior clypeal margin with a median impression or notch. Frontal carinae strongly developed and surmounted by a narrow rim or flange, forming the dorsal margin of a shallow but conspicuous broad scrobe. The scrobe is bounded ventrally by a feeble longitudinal carina, running above the eye, which also forms the posterior boundary of the scrobal area. Dorsal alitrunk in profile evenly convex, without trace of metanotal groove. Propodeal spines stout and acute, metapleural lobes triangular. Shape of pedicel segments as in Fig. 26, the petiole in dorsal view very slightly broader than long, the postpetiole conspicuously so. Dorsum of head finely but irregularly longitudinally rugulose with very feeble traces of a reticulum occipitally, the interspaces with very faint ground-sculpture. Dorsal alitrunk finely reticulate-rugulose, the meshes tending to be more conspicuous on the pronotum. Petiole and postpetiole with the faintest traces of ground-sculpture dorsally, almost smooth. Gaster unsculptured. Short fine hairs present on



Figs 17–29 *Tetramorium* workers. 17–27. Head and/or alitrunk of (17, 18) *isectum*, (19) *zenatum*, (20) *electrum*, (21) *coillum*, (22, 23) *anodontion*, (24) *dysalum*, (25) *ranarum*, (26) *ibycterum*, (27) *plesiarum*. 28, 29. Outline shape of petiole node in (28) *caldarium* and allies, (29) *scytalum*. Pilosity omitted from heads and from Figs 28 to 29.

dorsum of head but almost wholly confined to the dorsal surface of the frontal carinae. Longer fine, erect hairs present on dorsal alitrunk but very sparse, pronotum with 2 pairs, mesonotum with 1 pair, propodeum with 2 pairs in holotype, all located laterally where the dorsum meets the sides. Petiole, postpetiole and first gastral tergite without hairs, but the last with very fine appressed pubescence. Colour uniform light orange-brown.

Holotype worker, **Madagascar**: Côte Ouest, Jangoa, degraded for. litter, 18.i.1966 (*J-M. Betsch*) (MCZ, Cambridge).

In the *ranarum*-group *ibycterum* is unique in lacking any trace of pilosity on the first gastral tergite, and in this respect it resembles the *cognatum*-complex in the *schaufussi*-group. However, the shape of the petiole node and the presence of sculpture on the mandibles indicate that the true affinities of *ibycterum* lie with *ranarum* and its allies.

Tetramorium plesiarum sp. n.

(Fig. 27)

HOLOTYPE WORKER. TL 3·0, HL 0·74, HW 0·69, CI 93, SL 0·48, SI 69, PW 0·52, AL 0·84.

Mandibles very delicately longitudinally striate, anterior clypeal margin with a narrow median impression. Eyes moderate, maximum diameter 0·14, about 0·20 × HW, the maximum diameter with about 8 facets. Frontal carinae strong, surmounted by a narrow rim or flange and forming the upper margins of the strongly developed scrobes, which are bounded below by a strong longitudinal carina running above the eye and are divided into upper and lower portions by a strong median longitudinal carina which runs back well beyond the level of the posterior margin of the eye. The posterior margin of the scrobe is bounded by a downcurvature of the frontal carina which is directed towards the lower occipital corner (Fig. 27). Propodeum armed with a pair of narrow spines which are slightly upcurved along their length, the metapleural lobes elongate-triangular and acute. Petiole in profile high and quite narrow, the dorsal length less than the height of the tergal portion of the node. Postpetiole regularly convex. Petiole in dorsal view distinctly broader than long. Dorsum of head irregularly longitudinally rugulose, the interspaces with fine superficial punctulation. Dorsal alitrunk with spaced-out longitudinal rugulae, without transverse sculpture except on the extreme anterior pronotum. Spaces between rugulae glossy, with very feeble ground-sculpture. Dorsal surfaces of petiole and postpetiole unsculptured although the sides of these segments have some dense but faint punctulation. Gaster unsculptured. All dorsal surfaces of head and body with abundant fine pilosity. Colour brown.

Holotype worker, **Madagascar**: Causse de Kelifely, 20–30.xi.1974, forest humus and litter, dry forest (*A. Peyrieras*) (MCZ, Cambridge).

From the overall appearance of this species, and especially because of the strongly developed scrobes and dense pilosity, it seems to be an attempt by a member of the *ranarum*-group to acquire a *Triglyphothrix*-like habitus (but of course without the branched hairs), and these characters separate it well from related species in this group. The development of the scrobe is along the same lines but less complete in *zenatum*, but in this species the petiole node has a characteristic and very distinctive shape (Fig. 19).

Tetramorium quasirum sp. n.

HOLOTYPE WORKER. TL 2·4, HL 0·64, HW 0·58, CI 91, SL 0·40, SI 69, PW 0·42, AL 0·70.

Mandibles longitudinally striate; anterior clypeal margin with a median notch or impression. Eyes relatively small, maximum diameter 0·12, about 0·21 × HW, the eye noticeably elongate, about twice longer than broad. Frontal carinae not strongly developed, behind the level of the eyes no more strongly marked than the cephalic rugular sculpture which they merge into posteriorly. Antennal scrobes shallow and inconspicuous but less strongly sculptured than remainder of head. Propodeal spines acute, feebly upcurved along their length; metapleural lobes bluntly triangular. Petiole in profile strongly nodiform with roughly parallel, vertical anterior and posterior faces and an evenly convex dorsum, the length of the dorsum about equal to the height of the tergal portion of the node. Antero- and posterodorsal angles of the node narrowly rounded in profile and blunt. In dorsal view the node slightly longer than broad. Postpetiole evenly convex in profile. Dorsum of head closely and irregularly longitudinally rugulose with

some feeble cross-meshes, and merging into a disorganized reticulum posteriorly. Spaces between the rugulae conspicuously punctulate. Dorsal alitrunk reticulate-rugulose, more strongly marked than on head, the individual rugulae low and blunt, with a beaded appearance due to aligned punctulation on their upper surfaces. Spaces between them with feeble and sparse punctulation, less strong than on head. Dorsum of petiole with feebly marked sculpture, postpetiole and gaster smooth. All dorsal surfaces of head and body with numerous fine hairs, the gaster also with conspicuous long pubescence. Colour dark brown.

PARATYPE WORKERS. As holotype, some of them a lighter shade of brown. Dimensions TL 2·4–2·6, HL 0·62–0·64, HW 0·56–0·59, CI 90–94, SL 0·39–0·42, SI 69–73, PW 0·40–0·43, AL 0·69–0·72, maximum diameter of eye 0·11–0·12 (0·20–0·21 × HW) (10 measured).

Holotype worker, **Madagascar**: Bongolava, Pref. Tsiroanomandidy, 6–11.xii.1974, forest humus and litter, series AB 48 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. 14 workers with same data as holotype (MCZ, Cambridge; BMNH).

NON-PARATYPIC MATERIAL

A second series consisting of 4 workers and a female bear the data **Madagascar**: Rte d'Anosibé, km 33, 4–12.iv.1975, forest humus and litter, AB 49 (*A. Peyrieras*). These match the type-series well but are darker in colour, being black or nearly black.

This small species is related to *ranarum* but is smaller, has slightly larger eyes and much less strongly developed frontal carinae.

Tetramorium ranarum Forel

(Fig. 25)

Tetramorium (*Xiphomyrmex*) *ranarum* Forel, 1895*b*: 486. Syntype workers, MADAGASCAR: central Madagascar (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 3·0–3·3, HL 0·72–0·82, HW 0·68–0·76, CI 94–97, SL 0·48–0·54, SI 67–71, PW 0·48–0·55' AL 0·80–0·88 (8 measured).

Mandibles strongly longitudinally striate, anterior clypeal margin with a median notch or impression. Eyes relatively small, maximum diameter *c.* 0·13–0·14, about 0·17–0·19 × HW. Frontal carinae strong and surmounted by a raised narrow rim or crest, occipitally becoming weaker and merging into the other cephalic sculpture. Antennal scrobes shallow but broad, the scrobal area with some rugulose sculpture. Propodeal spines elongate and strong, tending to be upcurved along their length. Metapleural lobes broadly triangular and acute. Petiole node in profile blocky, about as long dorsally as the tergal portion is high. In dorsal view the petiole node about as broad as long, in some specimens slightly broader than long and *vice versa* in others. Postpetiole evenly convex in profile, much broader than petiole in dorsal view. Head predominantly bluntly longitudinally rugulose with some cross-meshes and with a reticulum occipitally, the dorsal surfaces of the blunt rugulae with a beaded appearance due to the presence of aligned punctulae. Spaces between rugulae weakly punctulate. Dorsal alitrunk reticulate-rugulose, the rugulae more strongly developed than on the head but still blunt and with the same beaded appearance. Petiole dorsum with traces of rugular sculpture, the postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs. Colour medium to dark reddish brown.

T. quasirum and *coillum* are the species most closely related to *ranarum*, the three of them sharing a similar habitus but differing in detail. Thus, *quasirum* is a noticeably smaller species than *ranarum* with relatively larger eyes, and *coillum* has the petiole more sharply angulate and retains rugulose sculpture on the postpetiole.

MATERIAL EXAMINED

Madagascar: Périnet (*W. L. Brown*); Andasibé (=Périnet) (*W. L. & D. E. Brown*).

Tetramorium zenatum sp. n.

(Fig. 19)

HOLOTYPE WORKER. TL 2·6, HL 0·64, HW 0·60, CI 94, SL 0·42, SI 70, PW 0·47, AL 0·72.

Mandible coarsely longitudinally striate, anterior clypeal margin with a distinct notch or impression.

Frontal carinae strong and surmounted by a narrow rim or flange, posteriorly weaker and curving downwards around the posterior part of the scrobe, not becoming confused with the sculpture of the occipital region. Scrobes shallow but broad, bounded below by a longitudinal carina running above the eye which is upcurved posteriorly and confluent with the downcurved frontal carina. Anteriorly the scrobe divided into upper and lower portions by a feeble median carina which ends just beyond the level of the eye. Eyes with maximum diameter 0·11, about 0·18 × HW. Propodeal spines short and acute, the metapleural lobes elongate-triangular. Petiole in profile very distinctly shaped, see Fig. 19, the dorsum flat. In dorsal view the node about as long as broad. Dorsum of head irregularly finely rugulose, forming a reticulum occipitally. Spaces between rugulae with a punctulate ground-sculpture. Dorsal alitrunk reticulate-rugulose, the dorsal surfaces of the rugulae feebly punctulate. Petiole node finely rugulose, the postpetiole and gaster unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous short, fine hairs. Colour orange-brown.

PARATYPE WORKER. As holotype but teneral and without full adult colour. Slightly smaller than holotype, TL 2·5, HL 0·62, HW 0·56, CI 90, SL 0·42, SI 75, PW 0·45, AL 0·69. The eye with maximum diameter 0·10.

Holotype worker, **Madagascar**: Causse de Kelifely, 20–30.xi.1974, forest humus and litter, dry forest AB 47 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. One worker and one dealate female with same data as holotype (MCZ, Cambridge; BMNH).

This species is closest related to *plesiarum*, both species sharing a similar strong development of the antennal scrobes, but the unique shape of the petiole node of *zenatum* quickly separates it from *plesiarum*, compare Figs 19 and 27. Also, the carina forming the lower scrobe margin is confluent with the frontal carina posteriorly in *zenatum*, but in *plesiarum* the two do not join, as indicated in Fig. 27.

The *tosii*-group

Antennae with 12 segments, sting appendage dentiform. Mandibles sculptured. Anterior clypeal margin entire, without trace of a median notch or impression. Body with erect or suberect fine hairs present but dorsal (outer) surfaces of hind tibiae without such hairs. Petiole node in profile elongate and low (Figs 31, 33). Frontal carinae running back well beyond the level of the eyes. Large species, HW > 0·90. Antennal scrobes absent.

The two species in this small group represent the only endemic members of *Tetramorium* in the entire Malagasy region in which the antennae are 12-merous and which are not obviously derived from any based on the Ethiopian region.

Tetramorium tantillum sp. n.

(Figs 30, 31)

HOLOTYPE WORKER. TL 4·5, HL 1·09, HW 0·92, CI 90, SL 0·74, SI 80, PW 0·70, AL 1·22.

Mandibles with faint and delicate longitudinal striation, the anterior clypeal margin arcuate and entire. Clypeus medially with only three longitudinal carinae. Eyes moderate, maximum diameter 0·21, about 0·23 × HW, not strongly protuberant. Frontal carinae long, almost reaching occipital region before merging with other cephalic sculpture, but not strong, no more strongly developed than the longitudinal rugae between them. The frontal carinae very weakly sinuate along their length, broadest at about level of eyes and converging slightly posteriorly, not diverging towards the occipital corners. Outline shape of lateral alitrunk as in Fig. 31. Propodeal spines straight and acute, metapleural lobes broad and bluntly triangular. Pedicel in profile as in Fig. 31, in dorsal view the petiole node roughly globular, very slightly broader than long and distinctly more voluminous than the postpetiole. Dorsum of head with irregular longitudinal rugae which are widely spaced, about 7 between the frontal carinae at the level of the eyes. Spaces between rugae with feeble ground-sculpture which amounts to little more than a slight roughening of the surface. Dorsal alitrunk with low, rounded, very weak rugae which form a feeble, almost effaced reticulum on the promesonotum. Dorsal surfaces of petiole and postpetiole smooth, with superficial faint markings which resemble an almost effaced fine reticulate-punctulation. Sides of petiole node with a few vestigial rugulae. Gaster unsculptured. All dorsal surfaces of head and body with numerous hairs, mostly erect or sub-erect. Colour uniform dark brown.

PARATYPE WORKERS. TL 4·2–4·4, HL 1·00–1·02, HW 0·88–0·90, CI 88–90, SL 0·70–0·74, SI 79–82, PW 0·64–0·68, AL 1·12–1·88. Maximum diameter of eye 0·19–0·21 (3 measured).

Holotype worker, **Madagascar**: Mangabé Isl., Antongil Bay 19.ii.1977, prim. rain forest, AB 42 litter (*W. L. & D. E. Brown*) (MCZ, Cambridge).

Paratypes. 3 workers with same data as holotype (MCZ, Cambridge; BMNH).

Closely related to *tosii* but not as specialized as that species. The eyes in *tantillum* are much less prominent, the scapes and propodeal spines shorter, and the petiole node is constructed differently (Figs 30, 31 and 32, 33).

Tetramorium tosii Emery

(Figs 32, 33)

Tetramorium tosii Emery, 1899 : 284, fig. Syntype worker, MADAGASCAR: Bai d'Antongil (*Mocquerys*) (MHN, Geneva) [examined].

WORKER. TL 5·2, HL 1·14, HW 0·98, CI 86, SL 0·96, SI 98, PW 0·76, AL 1·40.

Mandibles striate, anterior clypeal margin convex and entire. Clypeus with three very sharply raised longitudinal carinae running its length. Frontal carinae strong, running back well beyond the level of the eyes, becoming indistinguishable from the rugoreticulum on the occipital corners. Antennal scapes moderately long, SI approaching 100. Eyes unique in the genus, moderately sized but very strongly protuberant, projecting on each side of the head as a dome-shaped, strongly convex hemisphere. Occipital margin broadly and deeply concave in full-face view. Outline shape of alitrunk as in Fig. 33. Propodeum armed with a pair of very long, narrow, acute spines; metapleural lobes broadly triangular and feebly upcurved. Petiole in profile with an extremely long, curved peduncle anteriorly and with a long, low node which slopes upwards posteriorly. Shape of petiole in lateral and dorsal view as in Fig. 33. Dorsum of head sculptured with five coarse longitudinal rugae or carinae between the frontal carinae, the dorsal surfaces of which are finely beaded. A loose reticulum formed by widely spaced cross-meshes is present occipitally, and a reticulum is more strongly developed on the sides above and behind the eyes. Dorsal alitrunk largely unsculptured, with only scattered vestiges of low rugulae, the spaces between which are shining and have a fine superficial reticular ground-sculpture. Sides of pronotum much more strongly sculptured than dorsum. Sides of petiole with rugulose sculpture, but the dorsum and the entire postpetiole only with fine, faint superficial punctulation. First gastral tergite with faint superficial minute reticular markings, otherwise unsculptured. All dorsal surfaces with numerous fine erect or suberect hairs but these absent from the appendages where only fine pubescence is present. Colour uniform dark reddish brown, the gaster slightly darker in shade than the head and alitrunk.

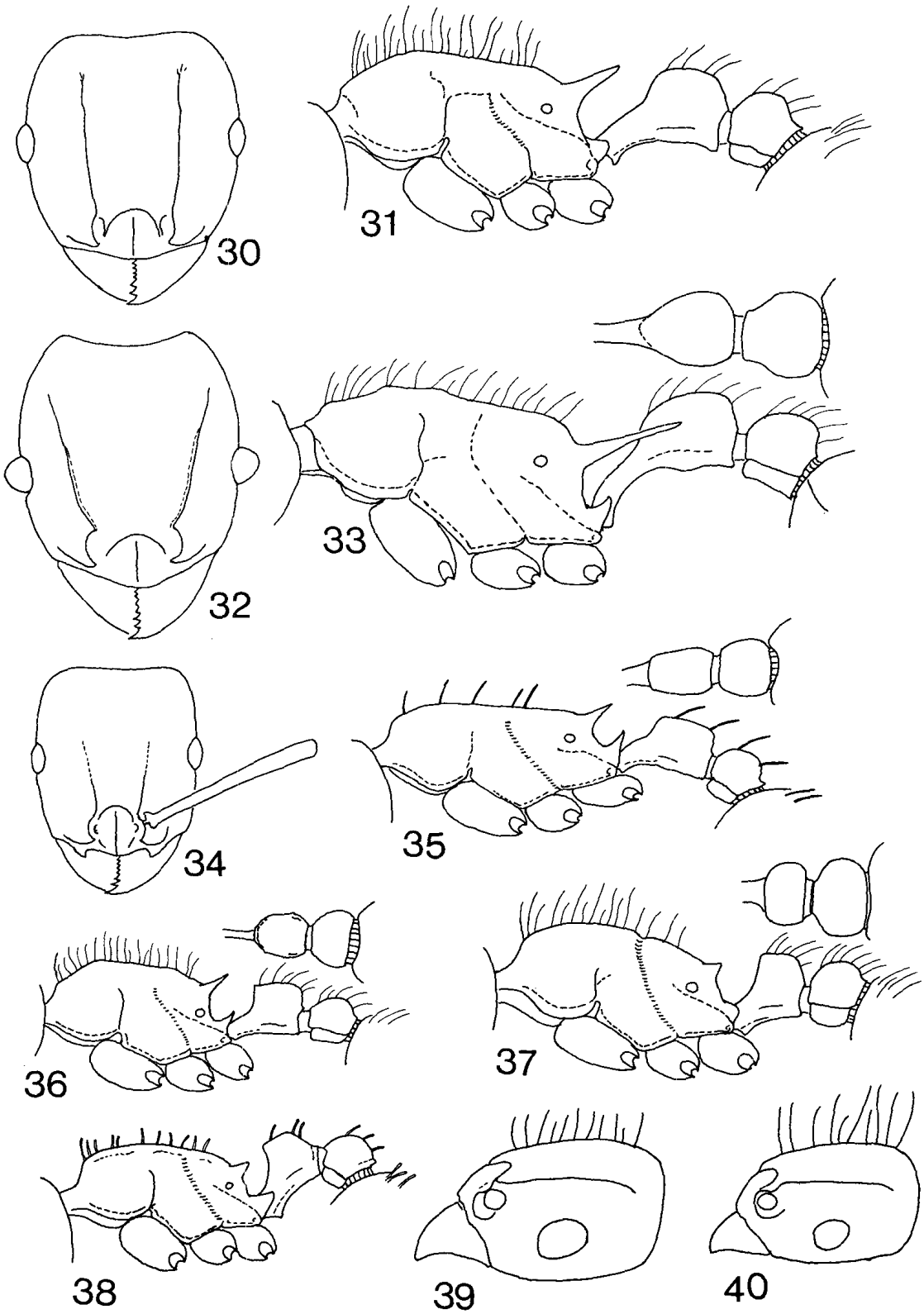
This large and spectacular species is not referable to any other species-group except in the vaguest ways. Its affinities seem to lie in the direction of the *tortuosum*-group, but there the antennae have only 11 segments and the sting appendage is spatulate, whereas in *tosii* the antennae are 12-merous and the sting appendage is pennant-shaped.

T. tosii should not be confused with any other Malagasy species as its combination of 12-merous antennae and unique eye-structure makes it immediately recognizable. It is separable from *tantillum*, its only known relative, by the different eye structure, size, shape of petiole and length of propodeal spines (compare Figs 30, 31 and 32, 33).

The *sericeiventre*-group

Antennae with 12 segments. Mandibles longitudinally striate. Anterior clypeal margin entire, without a median notch or impression. Lateral portions of clypeus modified, appearing roughly dentiform in full-face view (Fig. 34) but with the head viewed from above and slightly behind the raised lateral portions of the clypeus are seen to rise to a distinct high angular peak in front of the antennal insertions and then slope steeply down towards the median portion. Frontal carinae feeble or absent, never extending beyond eyes. Antennal scapes long, SI > 100; antennal scrobes absent. Propodeum bispinose. Petiole in dorsal view longer than broad. Sting appendage triangular to dentiform.

This group is strictly African and contains about a dozen species on that continent, most of which are arid-ground forms feeding largely or exclusively on ants of the genus *Pheidole*. Two species,



Figs 30–40 *Tetramorium* workers. Head and/or alitrunk of (30, 31) *tantillum*, (32, 33) *tosii*, (34, 35) *sericeiventre*, (36) *lucayanum*, (37) *caespitum*, (38) *simillimum*, (39) *bicarinatum*, (40) *insolens*. Pilosity omitted from heads.

in fact the two most common African species, have established themselves in the Malagasy region. In this region *sericeiventre* is known only from Madagascar, but *quadrispinosum* is more widely distributed, occurring also on several of the smaller island systems of the region.

Both of these species will be dealt with in more detail in the section of this study dealing with the Ethiopian regional fauna and so only summary treatment is given to them here.

Besides having the species-group characters noted above, both species have a number of stout, blunt hairs arising sparsely on the promesonotum, pedicel segments and gaster, but such hairs are absent from the propodeal dorsum. Both species are reddish in colour, usually with the gaster darker (sometimes black) but sometimes with very little difference in shade between alitrunk and gaster. The antennal scapes and the middle and hind tibiae lack standing hairs of any description and the petiole node in profile is long and low (Fig. 35). Differences between the two species rest rather uneasily upon the variable character of density and intensity of sculpture as tabulated in the key. In reality it is quite possible that *quadrispinosum*, a feebly or unsculptured form, and *sericeiventre*, a strongly sculptured form, may represent extremes of a single variable species.

For the present the two forms may be summarized as follows.

Tetramorium quadrispinosum Emery

Tetramorium quadrispinosum Emery, 1886 : 362, pl. 17, fig. 8. Syntype workers, SOUTH AFRICA: Cape of Good Hope (*L. Peringuey*) (MRAC, Tervuren; MHN, Geneva) [examined].

Tetramorium blochmanii var. *montanum* Forel, 1891*a* : 152, pl. 5, fig. 2a. Syntype workers, MADAGASCAR: nr Tamatave, Bois de l'Ivondrona (*C. Keller*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. With the group-characters given above and separable from *sericeiventre* only in terms of sculpture, which in *quadrispinosum* is feeble. In most specimens the entire dorsum of the head and alitrunk has only weak superficial punctulation or a surface reticulation, but in some a few faint longitudinal rugulae may be developed on the head, the alitrunk, or both. The gaster is often unsculptured but in some may have a superficial reticulation or a narrow band of feeble punctulation close to the base of the first tergite.

This species is widespread in southern Africa and is present in Madagascar. It appears to be fairly common on Aldabra I. and Cosmoledo Atoll.

Tetramorium sericeiventre Emery

(Figs 34, 35)

Tetramorium sericeiventre Emery, 1877 : 370. Syntype worker, ETHIOPIA: Sciotel (*Beccari*) (MHN, Geneva) [examined].

Tetramorium blochmanii Forel, 1887 : 384. Syntype workers, MADAGASCAR: nr Tamatave, Bois de l'Ivondro (*C. Keller*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. Very close to the above but more strongly sculptured. The dorsal surfaces of the head and alitrunk with conspicuous longitudinal rugae, the spaces between which are filled with a dense reticulate-puncturation and are matt and dull. The first gastral tergite is usually completely sculptured, matt and dull, but in a few the sculpture is distinctly stronger on the basal half of the tergite than on the apical.

T. sericeiventre is perhaps the commonest member of its genus in Africa in arid or semi-desert conditions or in any locality where the soil is insolated, sandy and well drained. It occurs from the Mediterranean littoral to the Cape and from the western to the eastern coasts. In the Malagasy region it is decidedly less common and appears to take second place to *quadrispinosum*.

The ***simillimum***-group

For definition of the group see page 169.

Madagascar has five representatives of this successful group of small species, two of which are restricted to the region (*anodontion* and *scytalum*) although closely related to the African parent-stock of the group. The other three species are shared with the Ethiopian region, one of them

being very widespread in eastern and southern Africa (*delagoense*), whilst the final two, *simillimum* and *caldarium*, are both accomplished tramp species with a very wide distribution outside Africa, their place of origin. These two tramp species are discussed under the section dealing with the New World fauna.

Tetramorium anodontion sp. n.
(Figs 22, 23)

HOLOTYPE WORKER. TL 2·6, HL 0·68, HW 0·60, CI 88, SL 0·48, SI 80, PW 0·42, AL 0·74.

Mandibles appearing dull and finely shagreened. (This appears to be an artifact caused by the presence of a waxy layer on the surface of the mandibular blades. In thoroughly cleaned paratypes the mandibles are shining with scattered pits.) Anterior clypeal margin entire, without notch or impression medially. Frontal carinae strong, convex along their length and surmounted by a narrow rim or flange, tending to peter out occipitally and become indistinguishable from the remaining sculpture. Eyes of moderate size, their maximum diameter 0·15, about 0·25 × HW. With the head in full-face view the sides immediately behind the eyes lacking a projecting stout hair. Outline of alitrunk as in Fig. 23, the metanotal groove very weakly marked. Propodeum absolutely unarmed, without trace of spines or teeth. Metapleural lobes broad and bluntly triangular. Node of petiole in dorsal view broader than long. Dorsum of head strongly sculptured, with numerous fine longitudinal rugulae and the interspaces packed with conspicuous reticulate-puncturation which also covers the scrobal areas. Dorsal alitrunk, petiole and postpetiole finely reticulate-rugulose, all interspaces covered by dense, distinctive reticulate-puncturation. First gastral tergite with faint shagreening basally but otherwise unsculptured. Short, stout, blunt hairs present on all dorsal surfaces of head and body. Colour medium brown, dull.

PARATYPE WORKERS. TL 2·5–3·1, HL 0·62–0·76, HW 0·57–0·68, CI 88–93, SL 0·45–0·54, SI 76–80, PW 0·40–0·47, AL 0·72–0·86 (18 measured). Maximum diameter of eye 0·14–0·17, about 0·24–0·25 × HW. As holotype but in a number of workers the waxy layer on the body has been lost so that in some the gaster appears dull, in others polished. In the clean specimens the shagreening of the first gastral tergite is more conspicuous.

Holotype worker, **Madagascar**: 'Bekonazy to 5 km S. forest W baobabs (n. of Morondava) 24 Mar. 1969, dry forest. M214, rot. pod of legum tree, shade' (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 28 workers with same data as holotype (MCZ, Cambridge; BMNH).

T. anodontion is unique in the Malagasy fauna of *Tetramorium* as it is the only species yet discovered in which the propodeum is completely unarmed.

Tetramorium delagoense Forel stat. n.

Tetramorium simillimum st. *delagoense* Forel, 1894 : 80. Syntype workers, queens, males, MOZAMBIQUE: Delagoa (*Dr Liengme*) (MHN, Geneva) [examined].

Tetramorium simillimum var. *madecassum* Forel, 1895*a* : 248. Holotype worker, MADAGASCAR: Imerina (*Sikora*) (MNH, Geneva) [examined]. **Syn. n.**

WORKER. TL 2·3–2·8, HL 0·56–0·66, HW 0·49–0·58, CI 84–89, SL 0·42–0·52, SI 84–92, PW 0·33–0·41, AL 0·61–0·80 (25 measured).

Mandibles finely sculptured with dense, weak striation or dense shagreening. Anterior clypeal margin entire. Frontal carinae strongly developed, extending back almost to the occiput and distinctly more strongly developed than the remaining cephalic sculpture. Antennal scrobes broad and quite shallow, but distinct. With the head in full-face view the sides immediately behind the eyes with a single short, stout hair projecting anteriorly. Alitrunk in profile usually with a slight indentation at the metanotal groove. Propodeal spines usually short and broadly triangular, sometimes reduced and blunted but never absent, the spines shorter than the metapleural lobes which are themselves broadly triangular in shape. Petiole node in profile somewhat variable in shape but usually the same as in *simillimum* (Fig. 38). In dorsal view the node broader than long. Dorsum of head longitudinally rugulose, the spaces between rugulae packed with a dense, conspicuous reticulate-punctate ground-sculpture or densely granular. Dorsal alitrunk finely rugulose, with distinct punctulation between the rugulae. Dorsal surfaces of petiole and postpetiole similarly but more faintly sculptured. All dorsal surfaces of head, alitrunk and gaster with scattered short, stout, blunt hairs. Colour yellowish brown to mid-brown.

This small species is a very close sibling of *simillimum* and was originally described as a variety of it. However, it differs consistently from *simillimum* by possessing a single projecting stout hair on the side of the head just below the eye, a feature absent from *simillimum*. Also, the scapes of *delagoense* tend to be relatively slightly longer, with SI 84–92, as opposed to SI 74–80 in *simillimum*.

Although known from Madagascar, *delagoense* does not appear to be very common there. It is an African species which has spread to Madagascar and it is common in eastern and southern Africa, being known from numerous collections from South Africa, Rhodesia, Angola, Tanzania, Kenya and Sudan.

MATERIAL EXAMINED

Madagascar: Bekonazy (nr Morondava) (*W. L. Brown*); Imerintsiatosika (nr Tananarivo) (*W. L. Brown*).

Tetramorium scytalum sp. n.

(Fig. 29)

HOLOTYPE WORKER. TL 2·1, HL 0·52, HW 0·45, CI 87, SL 0·36, SI 80, PW 0·33, AL 0·58.

Mandibles unsculptured except for scattered small pits; anterior clypeal margin entire. Frontal carinae feeble, beyond the level of the midlength of the eye not more strongly developed than the cephalic rugular sculpture, merely narrow, slightly raised continuous lines which fade out before reaching the occiput. Antennal scrobes vestigial. Eyes moderately developed, with 6–7 ommatidia across the greatest diameter. With the head in full-face view the sides behind the eyes weakly convex, rounding into the occipital margin which is very feebly concave medially. Sides of head behind eyes without projecting hairs although some faint, very short pubescence may be present. Propodeum armed with a pair of minute triangular denticles which are much shorter than the broad, triangular metapleural lobes. Node of petiole in profile characteristically shaped, quite long and low, with rounded angles and tapering from a broader base to a narrower apex, both anterior and posterior faces sloping inwards. In dorsal view the node is about as long as broad. Dorsum of head with widely spaced, very fine longitudinal rugulae, the spaces between them shining and with only faint superficial reticulation. Dorsal alitrunk similarly but less regularly and more weakly sculptured, with a tendency for the rugulae to break or fade out. Pedicel segments feebly sculptured, the gaster smooth. All dorsal surfaces of head and body with numerous short, stout, blunt hairs; the appendages with fine appressed pubescence. Colour dark blackish brown, the appendages somewhat lighter.

PARATYPE WORKERS. As holotype, measuring TL 2·0–2·2, HL 0·52–0·56, HW 0·44–0·48, CI 84–87, SL 0·35–0·40, SI 80–85, PW 0·32–0·35, AL 0·55–0·62 (12 measured). Some paratypes lighter brown than the holotype.

Holotype worker, **Madagascar**: Bekonazy to 5 km S, forest w. baobabs (N. of Morondava), 27.iii.1969, dry forest (*W. L. Brown*) (written beneath the lower data label is 'pile of baobob chips') (MCZ, Cambridge).

Paratypes. 14 workers with same data as holotype (MCZ, Cambridge; BMNH).

Diagnostic features of this small species include the shape of the petiole node and the unsculptured mandibles. It occurs quite commonly on Aldabra as indicated by 5 short series collected by V. Spaull in 1974–75 (BMNH) and a series collected by Cogan and Hutson in the same islands. These specimens resemble the type-series closely, the shape of the petiole being the same, but in a few faint traces of sculpture are present on the mandibles, there is a tendency for the alitrunk to be more strongly sculptured, and the colouring tends to be lighter brown than in the Malagasy material, although some are quite as dark brown as the types. The size range of the Aldabra material overlaps the range given for the paratypes, with some workers being slightly larger: HL 0·52–0·60, HW 0·44–0·52, CI 84–87, SL 0·36–0·42, SI 80–85, PW 0·32–0·36, AL 0·55–0·64 (12 measured).

New World species

The New World fauna of *Tetramorium*, including those species formerly placed in the junior synonym *Xiphomyrmex*, consists of 11 species, 7 of which are introduced and 4 of which belong to the endemic Nearctic *spinosum*-complex.

Of the introduced forms it has always been accepted that *simillimum*, *pacificum* and *bicarinatum* (this last referred to in earlier literature as *guineense*; see Bolton, 1977) were introduced in the past (M. R. Smith, 1943; Creighton, 1950; Brown, 1957), and more recently Brown (1964*a*) has proved that a similar origin is definite for *lucayanum*. There was some controversy over the status of *caespitum*, with Smith (1943) believing the species to be introduced and Creighton (1950) maintaining that it was endemic. Brown (1957) set out the argument for *caespitum* being an introduced form and on the whole I agree with his conclusions. In the same paper Brown also pointed out that debate over the origins of *T. rugiventris* was misplaced as the species belonged in fact to genus *Myrmica* (but see Gregg, 1961).

The present survey has shown that seven introduced *Tetramorium* species are present in the New World fauna, rather than five as implied in the latest previous estimate (Brown, 1964*a*). The two extra taxa both arise from the fact that more than one distinct species has been confused under a single name in both *simillimum* and *bicarinatum* in the past. *T. insolens* has been detected in a number of collections under *bicarinatum*, to which it is superficially very similar, but from which it differs consistently, and is now known as an introduction in Britain, Germany and the U.S.A. *T. caldarium*, long given as a synonym of *simillimum*, is actually quite distinct and appears to be reasonably common in the New World as to the present I have seen samples from the U.S.A., Mexico, Puerto Rico, Haiti, Dominican Republic, Colombia, Brazil and Peru.

Turning to the endemic forms, all of which belong to the *spinosum*-complex of the *tortuosum*-group, there seems to have been tacit agreement in all the above-mentioned publications, and in the first part of the present survey (Bolton, 1976), that only a single species was present, *spinosum*, represented by four subspecies in the more arid zones of southern U.S.A. and Mexico. These forms were reviewed and redescribed by M. R. Smith (1938) and his key was reproduced later by Creighton (1950) who, however, omitted the 'typical' Mexican form. From the material which I have examined I consider now that four more or less well-defined species are present in this complex which do not correspond to the old subspecies. This amounts to a fairly radical departure from the previously accepted taxonomy of the complex, and its validity or lack of it must stand or fall by the acquisition of further collections. The reasons for these revisionary changes are discussed under the species-group heading and under the individual species.

The list below tabulates a number of names from the New World which were described in *Tetramorium* but have since been removed to other genera. Details of original descriptions and authorities for the generic transfers are given.

Species excluded from *Tetramorium*

Tetramorium auropunctatum Roger, 1863 : 182. Transferred to genus *Wasmannia* Forel by Forel, 1893 : 383.

Tetramorium (Cephalomorium) bahai Forel, 1922 : 91. Transferred to genus *Pheidole* Westwood by Santschi, 1925 : 228.

Tetramorium balzani Emery, 1894 : 165. Transferred to genus *Hylomyrma* Forel by Brown, 1953 : 3 (via genus *Lundella* Emery. See also Kempf, 1973; Bolton, 1976).

Tetramorium foreli Emery, nomen nudum of Forel, 1893 : 383. Later described as *Rogeria foreli* Emery, 1894 : 191.

Tetramorium peritulum Cockerell, 1927 : 165. Transferred to genus *Lasius* F. by Carpenter, 1930 : 58 (see also Wilson, 1955 : 58).

Tetramorium reitteri Mayr, 1887 : 621. Transferred to genus *Hylomyrma* Forel by Brown, 1953 : 3 (via genus *Lundella* Emery. See also Kempf, 1973; Bolton, 1976).

Tetramorium rugiventris M. R. Smith, 1943 : 4. Transferred to genus *Myrmica* Latreille by Brown, 1957 : 6 (later placed in weak satellite genus *Paramyrmica* Cole, by Gregg, 1961 : 215).

Tetramorium sigmoidea Mayr, 1884 : 33. Transferred to genus *Wasmannia* Forel by Forel, 1893 : 383.

Tetramorium silvestrii Santschi, 1909 : 6. Transferred to genus *Leptothorax* Mayr by Emery, 1922 : 258 (see also Creighton, 1950).

Synonymic list of New World species

tortuosum-group

hispidum (Wheeler) **comb. et stat. n.**

***mexicanum* sp. n.**

***placidum* sp. n.**

spinosum (Pergande) **comb. n.**
wheeleri Forel **syn. n.**
spinosus subsp. *insons* Wheeler **syn. n.**
bicarinatum-group
bicarinatum (Nylander)
insolens (F. Smith)
pacificum Mayr
simillimum-group
caldarium (Roger) **stat. rev.**
pusillum var. *hemisi* Wheeler **syn. n.**
antipodum Wheeler **syn. n.**
minutum Donisthorpe **syn. n.**
simillimum (F. Smith)
caespitum-group
caespitum (L.)
brevinodis var. *transversinodis* Enzmann
caespitum var. *immigrans* Santschi **syn. n.**
camerunense-group
lucayanum Wheeler
camerunense var. *waelbroeki* Forel
lucayanum var. *sexdens* Forel
rectinodis Menozzi

Key to species (workers)

1 Antennae with 11 segments 2
– Antennae with 12 segments 5
2 Longest hairs projecting from antennal scapes and from dorsal (outer) surfaces of hind tibiae longer than the maximum width of the appendage from which they arise (Figs 52, 54). SI in range 94–99. (Mexico: Nayarit, Jalisco) . . . . . ***mexicanum*** (p. 161)
– Longest hairs projecting from antennal scapes and from dorsal (outer) surfaces of hind tibiae much shorter than the maximum width of the appendage from which they arise (Figs 50, 55). SI in range 79–90 3
3 Dorsum of postpetiole unsculptured. Small species, HW range 0·66–0·72. (Mexico: Nayarit, Jalisco) . . . . . ***placidum*** (p. 162)
– Dorsum of postpetiole sculptured. Larger species, HW range 0·77–>1·00 4
4 Eyes relatively large, maximum diameter 0·26 × HW at minimum, usually more. Hairs on pronotal dorsum and on upper frontal carinae short and straight, usually stubble-like, shorter than the maximum diameter of the eye. (U.S.A.: Texas, Arizona) ***hispidum*** (p. 161)
– Eyes relatively small, maximum diameter 0·25 × HW at maximum, usually less. Hairs on pronotal dorsum and on upper frontal carinae long, fine and often curved, many of them longer than the maximum diameter of the eye. (U.S.A.: Texas, Arizona. Mexico: Nuevo Leon, Sonora, Baja California, Nayarit, Jalisco, Michoacan, Zacatecas) ***spinosum*** (p. 163)
5 Hairs on promesonotal dorsum sparse, uniformly short, stout and blunt; the longest of them much shorter than the maximum diameter of the eye (Fig. 38) 6
– Hairs on promesonotal dorsum dense, uniformly elongate, slender and acute apically; the longest of them at least as long as the maximum diameter of the eye (Figs 36, 37, 43–45) 7
6 Frontal carinae strongly developed throughout their length, sinuate, running unbroken almost to the occipital margin and surmounted throughout their length by a narrow raised rim or flange. The whole of the frontal carinae much more strongly developed than the remaining cephalic rugulae (Fig. 41). Ground-sculpture of head between frontal carinae strongly granular or reticulate-punctulate, the surfaces matt. Antennal scrobes shallow but broad and conspicuous. (Cosmopolitan tramp species) . . . . ***simillimum*** (p. 170)
– Frontal carinae more feebly developed, weakly or not sinuate, most strongly developed to level of midlength of eye behind which they become very weak, or broken, or gradually fade out posteriorly; not surmounted by a raised rim or flange beyond the level of the mid-length of the eye, behind which the carinae are faint (Fig. 42). Ground-sculpture of head between carinae feeble, the surfaces dully shining. Antennal scrobes vestigial. (Tramp species mostly in tropics and subtropics) . . . . . ***caldarium*** (p. 169)
7 Dorsum of head behind level of eyes with regular longitudinal rugulation, without a rugo-reticulum occipitally 8
– Dorsum of head behind level of eyes with a coarse rugoreticulum, at least occipitally. . 9
8 Petiole in dorsal view longer than broad (Fig. 36). Frontal carinae strongly developed, reaching back beyond level of eyes (Fig. 48). Mandibles unsculptured or at most with very weak longitudinal markings. (Introduced in Caribbean countries) . . ***lucayanum*** (p. 172)
– Petiole in dorsal view broader than long (Fig. 37). Frontal carinae feeble, absent or indistinguishable from other cephalic sculpture (Fig. 49). Mandibles coarsely longitudinally striate. (Established in northern and eastern states of U.S.A., sporadically introduced elsewhere in New World) . . . . . ***caespitum*** (p. 171)

9 Mandibles sculptured with fine dense longitudinal striation or dense shagreening. Hairs on upper surface of frontal carinae between antennal insertions and occipital corners shorter than maximum diameter of eye (Fig. 39). Head and alitrunk yellow-brown to bright orange-brown, gaster much darker, blackish brown. (Cosmopolitan tramp species; widespread in Neotropics) . . . . . ***bicarinatum*** (p. 164)

– Mandibles smooth and shining with scattered pits. Hairs on upper surface of frontal carinae between antennal insertions and occipital corners longer than maximum diameter of eye (Fig. 40). Uniformly yellow or dark brown species, not bicoloured as above . . . 10

10 Uniformly clear yellow to light orange-brown, usually with the gaster lighter in shade than the alitrunk. First gastral tergite without basal costulae. (Sporadically introduced in New World) . . . . . ***insolens*** (p. 165)

– Uniformly dark brown or blackish brown. First gastral tergite with basal costulae. (Sporadically introduced in New World) . . . . . ***pacificum*** (p. 168)

The *tortuosum*-group

Antennae with 11 segments, sting appendage spatulate. Petiole nodiform and usually sculptured, at least on the sides; in dorsal view commonly longer than broad. Anterior clypeal margin often with a median notch or impression. Propodeum armed with spines or teeth. Mandibles striate. Dorsum of head generally with coarse rugose or rugulose sculpture but without strong ground-sculpture. Antennal scapes with SI $<$ 100 in most species, rarely slightly greater.

The endemic American–Mexican species *hispidum*, *mexicanum*, *placidum* and *spinosum* belong to a single tight-knit complex within this large group, the older species of which were originally described in genus *Xiphomyrmex*, now synonymized with *Tetramorium*.

The taxonomic history of the complex begins with the description by Pergande (1896) of *X. spinosus* from Baja California, the first endemic true tetramoriine to be recorded from the New World. This was followed in 1901 by *Tetramorium* (*Xiphomyrmex*) *wheeleri* Forel, also described from Mexico, and a little later by the description of two subspecies of *spinosus* from the U.S.A., *insons* and *hispidum* from Texas and Arizona respectively, which were named by Wheeler in 1915. Here the situation rested until the constituents were reviewed by M. R. Smith (1938), who regarded the complex as consisting of a single species with four subspecies corresponding to the names *spinosus*, *hispidus*, *insons*, *wheeleri*. However, he pointed out that 'the subspecies of *spinosus* represent extreme variations, and that there are other forms intermediate between the named forms. The existence of these intermediates might justify the synonymizing of the subspecies with the typical form'. Despite this statement the taxonomic system put forward by Smith was reproduced by Creighton (1950) in his useful study of North American ants.

The chief objection to Smith's (1938) system is expressed in the first couplet of his key, where he states:

1 First gastric segment finely punctulate, shagreened, subopaque toward the base . . . 2

– First gastric segment entirely smooth, except for scattered, piligerous punctures . . . 3

Very few samples from different localities need be examined to show that this character is very variable, and Creighton (1950) looked at a case in point, namely some material from the Huachuca Mts of Arizona which he said were 'intergrades between *insons* and *hispidus*'. In reality these specimens were intergrades between *spinosum* and *insons*, which represent a single species showing a fairly good west→east cline along which gastral sculpture decreases in an easterly direction.

Other characters chosen by Smith (and before him by Wheeler, 1915) are equally variable, such as the shape of the metapleural lobes (= metasternal angles) and the degree of development of the metanotal groove. Whilst searching for more stable characters it became apparent that the fauna consisted of a very widespread and variable species, *spinosum* (which was synonymous with *insons* and *wheeleri*), and that within the range of this species were three other valid species which differed consistently in all the available material. Some samples of these other species had been relegated to one or more of the subspecies in collections by reliance upon the older keys, but eventually a system emerged which had four fairly well-defined species which, except for *hispidum*, did not correspond with the older taxonomy.

In the present system *hispidum*, the only survivor of the old subspecies, is raised to the rank of good species, characterized by its combination of large eyes and short, bristly pilosity. The other subspecific names fall as synonyms of *spinosum*, but out of the mass of material formerly assigned here emerge two new Mexican species, *mexicanum* with very long, dense, conspicuous pilosity on body and appendages, and *placidum*, a small species with strongly reduced sculpture.

All of these species show a fair degree of variation and seem to indicate that the *spinosum*-complex is still radiating. Further collections may show up other sibling species in need of definition or, on the other hand, may turn up intermediates between the species here described, which will necessitate another look at the complex.

Tetramorium hispidum (Wheeler) **comb. et stat. n.**
(Figs 50, 51)

Xiphomyrmex spinosus subsp. *hispidus* Wheeler, 1915 : 415. Syntype workers, U.S.A.: Arizona, desert E. of Tucson, 22.xi.1910 (*W. M. Wheeler*) (USNM, Washington; MCZ, Cambridge; BMNH) [examined].

WORKER. TL 3·9–4·5, HL 0·90–1·02, HW 0·84–0·94, CI 89–94, SL 0·68–0·82, SI 81–89, PW 0·64–0·74, AL 1·16–1·38 (30 measured).

Mandibles densely longitudinally striate. Frontal carinae strongly developed, sinuate, surmounted by a semitranslucent raised rim or flange which is highest behind the frontal lobes and gradually becomes lower posteriorly. Antennal scrobes narrow but capable of receiving the scape. Eyes both absolutely and relatively large, their maximum diameter 0·22–0·26, about 0·26–0·30 × HW. Propodeal spines short, stout and acute. Metapleural lobes varying in shape from a short, broad but acute triangle to a rounded-triangular lobe, never elongate-spiniform and often as broad or broader across the base than they are long. Dorsum of head longitudinally rugulose, the constituents spaced out and usually gently sinuate or irregular along their length, but not vermiculate. Reticular cross-meshes sparse or absent in front of the level of the posterior margins of the eyes but the occiput usually with a rugoreticulum. Dorsal alitrunk and petiole coarsely reticulate-rugose, the latter less strongly so than the former. Dorsum of postpetiole less strongly rugose than petiole but with more strongly developed punctulate sculpture between the rugae. Elsewhere dense punctulate sculpture is usually conspicuous on the head between the rugulae but is much weaker on the dorsal alitrunk. First gastral tergite with a basal band of dense punctulation or shagreening which may be faint in some individuals but apparently is never absent in this species. All dorsal surfaces of head and body with dense, short, bristly pilosity, the longest hairs on the alitrunk at most only approaching the maximum diameter of the eye and usually much shorter. Pilosity on leading edge of antennal scapes and dorsal (outer) surface of hind tibiae erect to subdecumbent, very short, less than half the maximum diameter of the appendage from which they arise. Colour varying from reddish yellow to deep red-brown.

Formerly treated as a subspecies of *spinosum*, the above series of diagnostic characters seem consistent and indicate that *hispidum* is best regarded as a valid species. The combination of large eye and short bristly pilosity is not repeated elsewhere in the complex and although some specimens of *spinosum* from Baja California approach *hispidum* in size of eye they have the elongate, less bristly pilosity characteristic of that species.

The punctulation or shagreening of the base of the first gastral tergite seen in this species is variable in density and intensity. In most samples it is coarse and distinct but occasionally it may be so faint as to be visible only under the correct lighting conditions.

MATERIAL EXAMINED.
U.S.A.: Texas, Langtry (*W. M. Wheeler*); Texas, Pesidio Co., Alamito (*W. M. Wheeler*); Arizona, Catalina Mts, Fenner Canyon (*W. M. Wheeler*); Arizona, Cochise Co., Portal (*W. L. Brown*); Arizona, Phoenix (*L. C. Murphree*); Arizona, nr Oracle (*L. G. Werner*); Arizona, Tucson (*W. M. Wheeler*); Arizona, Huachuca Mts, Miller Canyon; Arizona, Mesa (*L. C. Murphree*).

Tetramorium mexicanum **sp. n.**
(Figs 52–54)

HOLOTYPE WORKER. TL 4·9, HL 1·04, HW 0·92, CI 88, SL 0·88, SI 96, PW 0·74, AL 1·38.

Mandibles longitudinally rugulose. Frontal carinae strongly developed to level of posterior margin of eye but behind this rapidly decreasing and becoming indistinguishable from the remaining cephalic sculpture. Antennal scrobes weak, not capable of accommodating the scapes. Antennal scapes long, SI 96 in holotype, with a range of 94–99 in entire type-series (in other members of the complex SI 90 or less). With the head in full-face view the scapes when laid back just exceed the occipital corner. Eyes relatively small, maximum diameter 0·20, about 0·21 × HW. Propodeal spines long, strong and acute; metapleural lobes very elongate-triangular. Outline shape of alitrunk and pedicel as in Fig. 53. Dorsum of head coarsely and irregularly rugose, vermiculate in places, and with numerous cross-meshes, many of which are broken or incomplete. Occiput with a coarse rugoreticulum. Dorsal alitrunk coarsely and sharply rugose, the rugae predominantly longitudinally sinuate or vermiculate but forming a reticulum in places. Petiole and postpetiole similarly but less strongly sculptured. Punctulate ground-sculpture feeble on head and alitrunk dorsally but becoming more distinct on petiole and postpetiole. First gastral tergite unsculptured except for hairpits. Pilosity quite spectacularly developed, with long fine acute hairs abundant on all dorsal surfaces; the longest of those on the pronotum >1·5 × maximum eye diameter. Leading edge of antennal scapes and dorsal (outer) surfaces of hind tibiae with numerous long hairs, the longest of which distinctly exceed the maximum diameter of the appendage from which they arise. Colour red-brown.

PARATYPE WORKERS. TL 4·8–5·2, HL 1·00–1·12, HW 0·90–1·00, CI 87–90, SL 0·88–0·98, SI 94–99, PW 0·74–0·80, AL 1·36–1·48 (14 measured). As holotype but some lighter in colour, reddish orange, and with the metapleural lobes broader than in the holotype. Metanotal groove variously developed. In holotype visible in profile but in most paratypes not at all impressed. Eyes uniformly small, maximum diameter 0·19–0·21, about 0·20–0·22 × HW. Cephalic sculpture rather more sharply developed in Tepic paratypes than in those from Puerto Los Mazos.

Holotype worker, **Mexico**: Jalisco, Puerto Los Mazos, 10 miles SW. Autlán, 4400 ft, 25.ix.1973, leaf litter forest floor (*A. Newton*) (MCZ, Cambridge).

Paratypes. **Mexico**: 2 workers with same data as holotype; 12 workers, Nayarit, Tepic (*W. M. Mann*) (MCZ, Cambridge; BMNH; LACM, Los Angeles; USNM, Washington).

This large species is characterized by its long antennal scapes, very long dense pilosity, coarse sculpture and small eyes. The first two characters are absolutely diagnostic in available material, the length of the hairs not being approached by any sample of any other species of the complex, and the SI range of 94–99 is higher than in all others, whose combined SI range is 76–90.

Tetramorium placidum sp. n.

(Fig. 46)

HOLOTYPE WORKER. TL 3·4, HL 0·76, HW 0·69, CI 91, SL 0·56, SI 81, PW 0·54, AL 0·92.

Mandibles coarsely longitudinally striate; anterior clypeal margin without a median impression. Frontal carinae feebly sinuate, strongly developed through most of their length but becoming weaker close to the occiput, scarcely more strongly developed than the remaining cephalic rugular sculpture. Antennal scrobes weak. Eyes of moderate size, maximum diameter 0·15, about 0·22 × HW, situated at the mid-length of the sides of the head. Propodeal spines short and stout, basally broad but tapering to an acute and slightly upcurved apex. Metapleural lobes long and very narrowly triangular, about 0·75 × the length of the propodeal spines. Outline shape of alitrunk and pedicel as in Fig. 46. Dorsum of head finely reticulate-rugulose from level of anterior margin of eye to occiput, the reticular cross-meshes only slightly weaker than the longitudinal components. Dorsal alitrunk reticulate-rugose. Ground sculpture of both head and dorsal alitrunk a feeble punctulation, effaced in places, especially between the alitrunkal reticulations. Dorsum of petiole irregularly rugulose, dorsum of postpetiole unsculptured, smooth and polished. First gastral tergite unsculptured except for pits from which hairs arise. Standing fine pilosity abundant on all dorsal surfaces but the leading edges of the antennal scapes and the dorsal (outer) surfaces of the hind tibiae only with short, fine hairs which are subdecumbent to decumbent. Colour reddish brown.

PARATYPE WORKERS. As holotype, with range of dimensions TL 3·3–3·4, HL 0·76–0·78. HW 0·69–0·72, CI 91–92, SL 0·56–0·58, SI 80–84, PW 0·52–0·54, AL 0·90–0·92 (2 measured).

Holotype worker, **Mexico**: Jalisco, Puerto Los Mazos, 10 miles SW. Autlán 4400 ft, 25.ix.1973, leaf litter forest floor (*A. Newton*) (MCZ, Cambridge).

Paratypes. 2 workers with same data as holotype (BMNH; LACM, Los Angeles).

Apart from the type-series a short series in alcohol is present in CAS, San Francisco (determined as *spinosum*). These fit the above description but are lighter in colour (orange-yellow) and somewhat smaller than the types, HL 0·70–0·72, HW 0·66–0·68, CI 94, SL 0·50–0·52, SI 76, PW 0·50–0·52, AL 0·86–0·88 (3 measured). They come from Mexico: Nayarit, San Blas, 17.ix.1953 (*B. Malkin*).

This species is distinguished by its small size and unsculptured postpetiole.

Tetramorium spinosum (Pergande) **comb. n.**

(Fig. 55)

Xiphomyrmex spinosus Pergande, 1896 : 894. LECTOTYPE and three paralectotype workers, MEXICO: Baja California, Sierra San Lazaro, Cape Region (*Eisen & Vaslit*) (USNM, Washington), here designated [examined].

Tetramorium (*Xiphomyrmex*) *wheeleri* Forel, 1901 : 128. Syntype workers, MEXICO: Zacatecas, Pacheco (*W. M. Wheeler*) (MHN, Geneva) [examined]. **Syn. n.**

Xiphomyrmex spinosus subsp. *insons* Wheeler, 1915 : 416. Syntype workers, U.S.A.: Texas, Austin (*W. M. Wheeler*) (MCZ, Cambridge; BMNH) [examined]. **Syn. n.**

WORKER. TL 3·6–5·1, HL 0·84–1·12, HW 0·77–1·04, CI 88–96, SL 0·62–0·88, SI 79–90, PW 0·58–0·82, AL 0·98–1·42 (100 measured).

Mandibles strongly longitudinally striate. Anterior clypeal margin usually with a median impression but this may be very shallow or vestigial in some samples. Frontal carinae strongly developed, running back well beyond the level of the posterior margins of the eyes but towards the occipital corners fading out and blending into the occipital rugoreticulum. Throughout their length the frontal carinae with a raised, semitranslucent ridge which is highest anteriorly and gradually becomes lower posteriorly. Eyes moderate to fairly large, maximum diameter 0·18–0·24, about 0·20–0·25 × HW but with relatively few samples in the upper range. Propodeal spines varying from elongate-triangular to long-spiniform, with all intermediates. Similarly, the metapleural lobes varying from low, broadly triangular structures to elongate spiniform teeth. Dorsum of head longitudinally rugulose, the rugulae irregular or sinuate along their length. Reticular cross-meshes usually present in western samples but tending to be reduced or absent in those from the east, but a rugoreticulum present occipitally in all cases. Dorsal alitrunk rugose, predominantly longitudinally so but with a rugoreticulum present at least on the pronotum; sometimes everywhere reticulate-rugose. Dorsum of petiole and postpetiole irregularly rugose or rugulose, the former more strongly so than the latter. First gastral tergite varying from completely smooth to strongly punctulate basally, with all intermediate phases apparent. Pilosity on all dorsal surfaces of head and body elongate, fine and dense, acute apically; the longest hairs on the dorsal alitrunk longer than the maximum diameter of the eye. Hairs on leading edge of antennal scapes and on dorsal (outer) surfaces of hind tibiae varying from erect to subdecumbent but always shorter than the maximum diameter of the appendage from which they arise. Colour reddish yellow to reddish brown, often with the gaster lighter in shade than the head and alitrunk.

This is the most common, most widely distributed and most variable species of the *spinosum*-complex in North America. Variation in *spinosum* takes the form of a rough double cline, one running from west to east and the other from north to south. Predominant variation on the west–east axis, which runs from Baja California across to Texas, is the reduction of sculpture on the first gastral tergite. In specimens from Baja California the base of the tergite is usually distinctly sculptured, but further east in Arizona it is reduced to fainter markings and in Texan material the gaster is smooth. Exceptions to the trend occur in Jalisco where specimens without gastral sculpture are quite common, but despite this it is now obvious that gastral sculpture is of no use in separating the species of this complex. On the north–south axis the most obvious variation is in the length of the propodeal spines, which start off quite short in Arizona and other northern areas and show an overall gradual increase in length as one moves south, ending up long and narrow in Jalisco and Zacatecas. To a lesser degree the metapleural lobes share in this trend as specimens from Jalisco tend to have them much longer and more definitely spiniform than do specimens from further north where they tend to be more markedly triangular. In some specimens from Arizona the metapleural lobes are low and very broad, approaching the condition seen in *hispidum*.

The above discussion shows trends in variation, but it should be noted that here and there odd samples form exceptions to the rule and other variation, which appears to be sporadic, is also present. This includes the density and degree of elevation of tibial pilosity and intensity of sculpture. The second of these does not appear to have any pattern to it, but the tibial pilosity can be summarized thus: specimens from Texas and Nuevo Leon tend to have numerous fine hairs on the dorsal (outer) tibial surface which are subdecumbent, gently curved along their length and inclined towards the tibial apex. Material from Jalisco, on the other hand, tends to have fewer hairs on the outer tibial surface and those present are generally suberect and straight. In intermediate zones (Arizona to W. Texas) and in Baja California both forms occur as do intergrades between the two extremes.

The three other species of the complex which occur inside the vast range of *spinosum* are best separated from it by reference to characters which the central species does not possess, such as long pilosity and elongate antennal scapes in *mexicanum*, small size and unsculptured postpetiole in *placidum* and large eyes and short stubbly pilosity in *hispidum*.

MATERIAL EXAMINED

U.S.A.: Texas, Austin (*W. M. Wheeler*); Austin (*R. A. Cushman*); Texas, Bulverde (*D. H. Bixby*); Brownsville (*H. S. Barber*); Brownsville (*W. S. Ross*); Bexar Co., Helotes; Texas, Ozona (*A. C. Cole*); Texas, Junction (*S. E. Aldous*); Beeville (*Pergande*); San Diego (*Pergande* ?); Texas, Del Rio (*W. M. Mann*); Bracketville (*M. P. Creighton*); Arizona, Cochise Co., Huachuca Mts, Ash Canyon (*R. R. Snelling*); Carr Canyon (*R. R. Snelling*); Ramsey Canyon (*W. S. Creighton*); Pinaleno Mts, Post Canyon (*W. M. Wheeler*); Santa Cruz Co., Pena Blanca Spring (*Bryan*). **Mexico**: Nuevo Leon, nr Linares (*E. M. & J. L. Fisher*); Sonora, Nogales; Baja California, Los Parras (*R. R. Snelling*); Los Parras (*W. M. Mann*); Baja California, Purissima (*W. M. Mann*); Loreta (*W. M. Mann*); Jalisco, Atenquique (*Dixon & Heyer*); Nevado de Colima (*A. Newton*); S. of Mazamitin (*E. S. Ross*); Jalisco, Cocula (*W. M. Mann*); Cocula, San Diego (*W. M. Mann*); Michoacan, Uruapan (*W. M. Mann*); Nayarit, Tepic, Santiago (*T. Pergande*).

The *bicarinatum*-group

Antennae with 12 segments, sting appendage triangular, dentiform or pennant-shaped. Anterior clypeal margin with a median notch or impression. Median portion of clypeus with three principal longitudinal carinae, often without other sculpture but sometimes with another much weaker pair of carinae. Mandibles variously sculptured, smooth to striate. Frontal carinae strongly developed, reaching back almost or quite to the occipital margin. Propodeal spines always strongly developed, straight to somewhat upcurved along their length. First gastral tergite commonly costulate basally. Basic sculpture throughout the group a strong rugoreticulum. Pilosity usually abundant, elongate and fine; short truncated hairs absent.

This group contains a number of the larger and more conspicuous members of the genus. The Oriental/Indo-Australian region has a total of 13 species and the Ethiopian region about 15.

One species of the group, *bicarinatum*, is a highly successful tramp-species and has been recorded from all over the world except for the Ethiopian region. Two other members of the group have some tramping ability, *insolens* and *pacificum*. The former closely resembles *bicarinatum* and has been found to date in Britain, Germany and the U.S.A., but always as an introduction or living in zoological or botanical gardens. The latter occurs sporadically in California where it has been recorded by M. R. Smith (1943) and Creighton (1950). The species has an enormous range in the Indo-Australian and Oriental regions and seems to be present on most of the Pacific island-systems, so it is hardly surprising that it should occur occasionally on the west coast of the United States.

Tetramorium bicarinatum (Nylander)

(Figs 39, 43, 47)

Myrmica bicarinata Nylander, 1846 : 1061. Syntype workers, female, U.S.A.: California, 1840 (types lost).

Tetramorium bicarinatum (Nylander); Mayr, 1862 : 740. [For a full statement of the current synonymy of *bicarinatum*, application of the name and discussion of the species see Bolton, 1977 : 94.]

WORKER. TL 3·4–4·5, HL 0·80–1·00, HW 0·68–0·86, CI 80–87, SL 0·54–0·68, SI 75–84, PW 0·50–0·62, AL 0·94–1·20 (114 measured).

Mandibles very finely and densely longitudinally striate; extremely rarely the mandibles appearing finely shagreened. Anterior clypeal margin with a marked median notch or impression. Median portion of clypeus with three longitudinal carinae of about equal strength, a median and one on each side. Sometimes another carina present on each side of the median but these are very feeble by comparison and nearly always incomplete or broken. Frontal carinae strong, running back almost to the occiput and equipped above with a narrow, raised semitranslucent rim or flange. Eyes relatively large, maximum diameter *c.* 0·19–0·24 so that diameter of eye is 0·26–0·29 × HW. Pronotal angles sharp in dorsal view. Metanotal groove absent but some specimens with a shallow impression in the alitrunk outline at its approximate position. Propodeal spines in profile strong and acute, moderately long, varying from more or less straight to slightly upcurved along their length. Metapleural lobes elongate-triangular and upcurved. Petiole node in profile roughly rectangular, with parallel or almost parallel anterior and posterior faces and an evenly convex dorsum which meets each face in an angle. The anterodorsal and posterodorsal angles of the node in profile are on a level as the dorsum of the node does not slope upward posteriorly. Dorsum of head with scattered irregular longitudinal rugae with a few cross-meshes but behind the level of the eyes with a strong rugoreticulum (Fig. 47). Ground-sculpture between the rugae superficial and inconspicuous. Dorsum of alitrunk, petiole and postpetiole reticulate-rugose, the sides of the pedicel segments similarly sculptured. Gaster unsculptured for the most part but nearly always with some short, fine, basal costulae on the first tergite. These may be very faint but are only rarely completely absent. All dorsal surfaces with numerous erect or suberect hairs, those projecting from the dorsum of the frontal carinae between the antennal insertions and the occipital corner relatively short (by comparison with other species of the group), shorter than the maximum diameter of the eye. Head, alitrunk, petiole and postpetiole varying from light yellow-brown to bright orange-yellow, the gaster always much darker, deep brown or blackish brown.

T. bicarinatum is a highly successful tramp species which appears to have originated in SE Asia. It is now reasonably common throughout the tropical and subtropical zones of the world except for the Ethiopian region, from which it is unknown. In temperate zones *bicarinatum* is capable of establishing itself in hothouses, conservatories and other constantly heated buildings.

It is the only member of its group to be found in Madagascar, but in the New World two closely related species also occur as introductions. These are *pacificum* and *insolens*, both of which differ from *bicarinatum* in having the mandibles smooth and shining. In addition to this, the petiole node is very differently shaped in *pacificum* (compare Figs 43 and 44) and the ant is uniformly dark brown or black in colour. *T. insolens* also differs in colour from *bicarinatum*, having the gaster the same colour or lighter than the head and alitrunk, and in addition having relatively much longer hairs on the dorsum of the frontal carinae, which are distinctly longer than the maximum diameter of the eye (compare Figs 39 and 40).

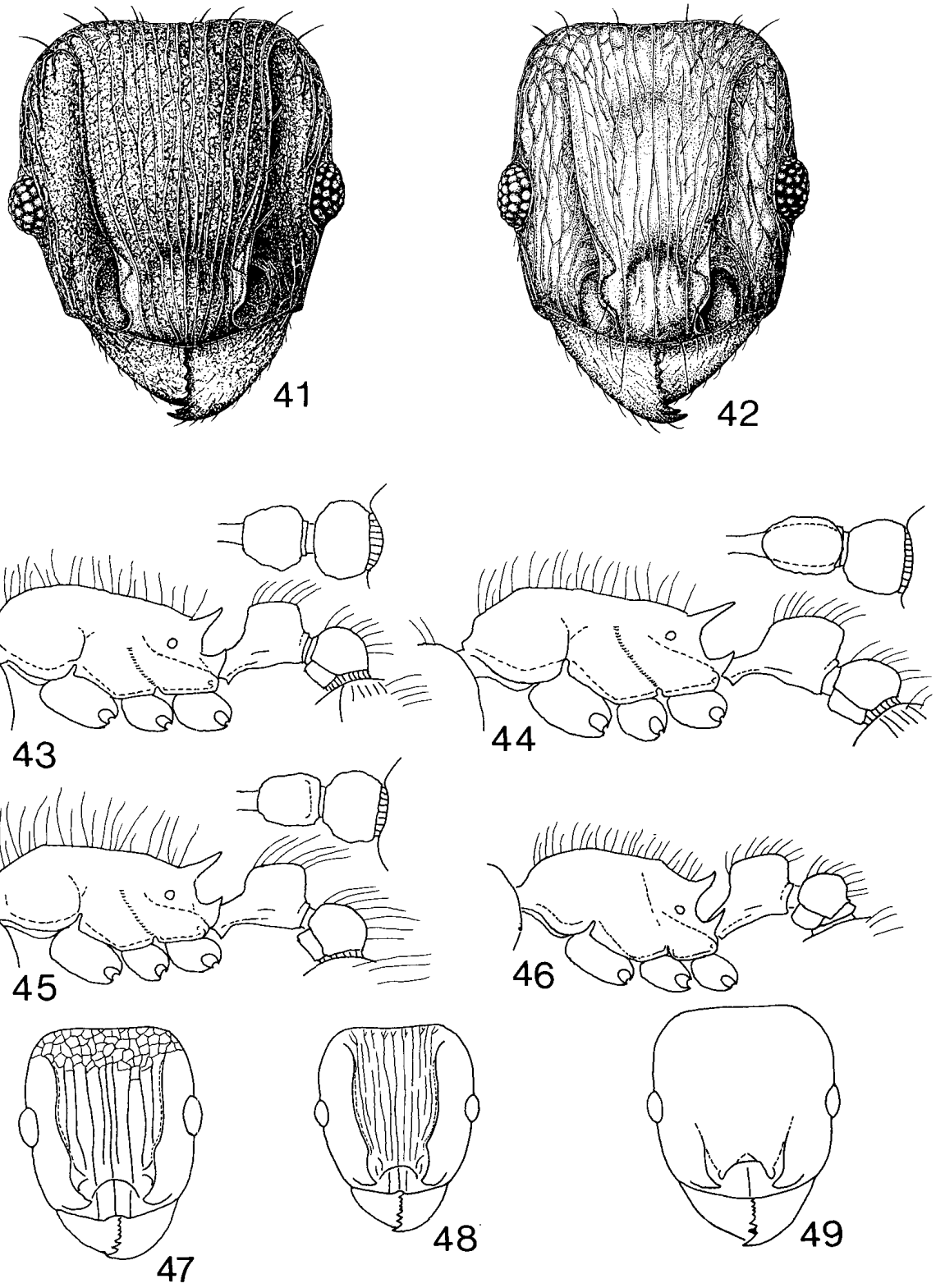
For a full list of material previously examined see Bolton (1977 : 96). In this study I have examined material of the Neotropical region from Mexico, Trinidad, Cuba, Puerto Rico, Antigua, Dominican Republic, Barbados, Haiti, Panama, Costa Rica, Honduras, Nicaragua, Venezuela, Colombia, Bolivia, Guiana, Brazil and Peru, which indicates that *bicarinatum* is fairly well established in the neotropics. Material from North America has been seen from the Bahamas, Florida, New York, Ohio, Wisconsin, Illinois, Georgia, Texas, W. Virginia, California. The majority of this material is deposited in USNM, Washington; MCZ, Cambridge; LACM, Los Angeles; BMNH.

Tetramorium insolens (F. Smith)
(Figs 40, 45)

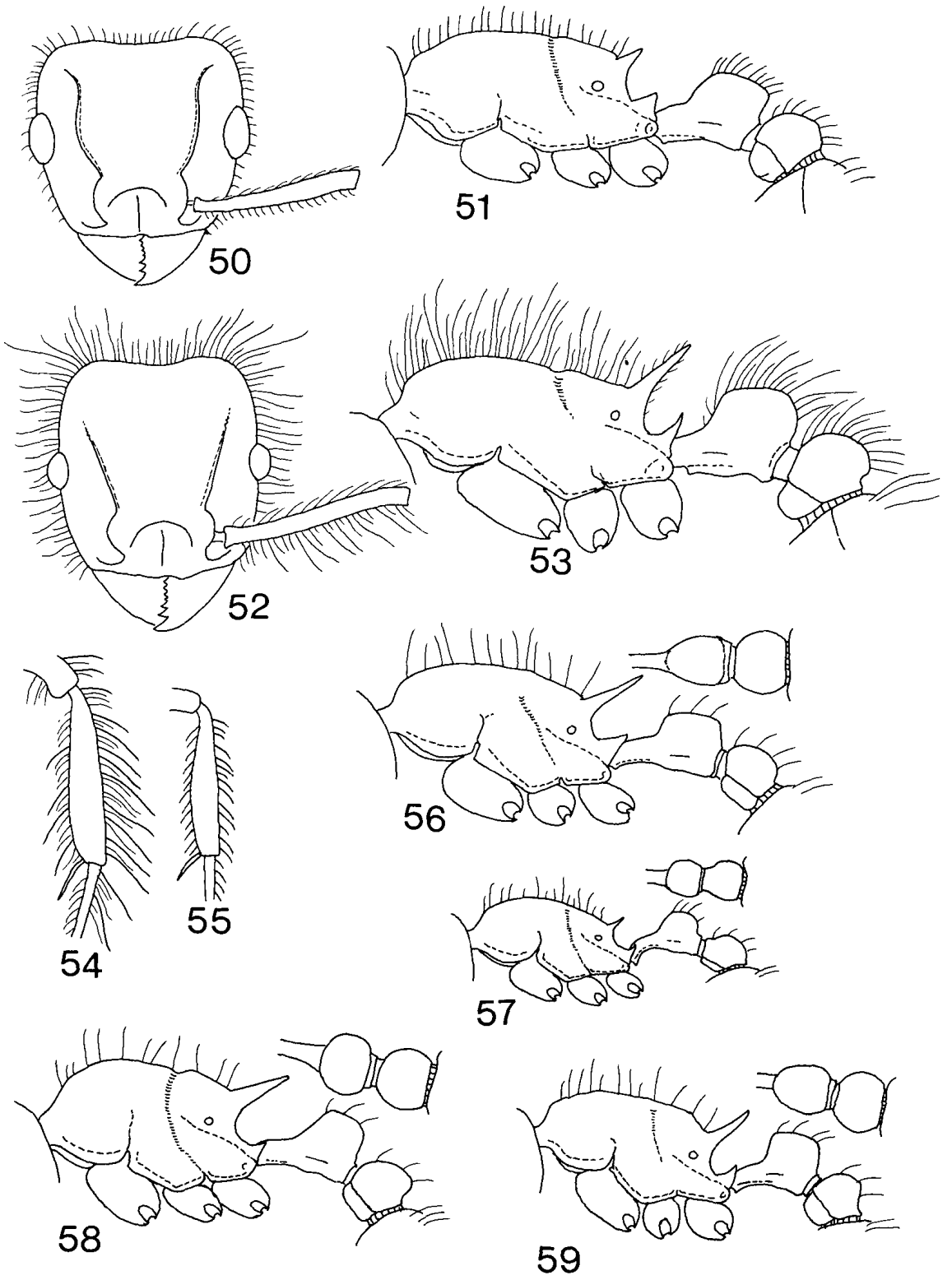
Myrmica insolens F. Smith, 1861 : 47. Holotype female, SULAWESI: Menado (*A. R. Wallace*) (UM, Oxford) [examined].

Tetramorium insolens (F. Smith); Donisthorpe, 1932 : 468. [For a full statement of current synonymy of *insolens* see Bolton, 1977: 99 with the exception of *melanogyna* Mann, for which see p. 173, this paper.]

WORKER. TL 3·3–4·0, HL 0·78–0·94, HW 0·68–0·84, CI 84–88, SL 0·56–0·68, SI 78–86, PW 0·50–0·62, AL 0·92–1·08 (40 measured).



Figs 41–49 *Tetramorium* workers. Head or alitrunk of (41) *simillimum*, (42) *caldarium*, (43) *bicarinatum*, (44) *pacificum*, (45) *insolens*, (46) *placidum*, (47) *bicarinatum*, (48) *lucayanum*, (49) *caespitum*. Pilosity omitted in Figs 47–49.



Figs 50–59 *Tetramorium* workers. Head and alitrunk of (50, 51) *hispidum*, (52, 53) *mexicanum*. 54–55. Hind tibia of (54) *mexicanum*, (55) *spinosum* to show pilosity. 56–59. Alitrunk of (56) *palaense*, (57) *ocothrum*, (58) *rekhefe*, (59) *belgaense*. Fringing pilosity only indicated in Figs 50 and 52.

Mandibles smooth and shining, unsculptured except for scattered pits. Anterior clypeal margin with a median notch or impression; median portion of clypeus with three strong longitudinal carinae. Frontal carinae long and strong, extending back almost to occiput. Eyes of moderate size, maximum diameter *c.* 0·18–0·20, about 0·23–0·26 × HW. Pronotal corners in dorsal view angular. Propodeal spines long and stout, generally somewhat upcurved along their length, more rarely with the extreme apex of each spine suddenly upcurved. Metapleural lobes triangular, acute, somewhat upcurved. Petiole node in profile with anterior and posterior faces approximately parallel, the dorsum convex and rising slightly posteriorly so that the anterodorsal angle is on a slightly lower level than the posterodorsal, the latter angle usually sharper than the former, which has a tendency to be rounded. Dorsum of head to level of eyes with sparse longitudinal rugulae with a few cross-meshes and a fine but fairly conspicuous ground-sculpture. Behind the level of the eyes the head is reticulate-rugose. Dorsal alitrunk with an irregular rugoreticulum which is usually strongest on the pronotum. Petiole and postpetiole reticulate-rugose both laterally and dorsally. Gaster unsculptured. All dorsal surfaces of head and body with abundant long erect or suberect hairs, those situated in a row on the upper surfaces of the frontal carinae between antennal insertion and occiput very long, distinctly longer than the maximum diameter of the eye. Colour varying from clear pale yellow to light orange-brown, usually with the gaster distinctly lighter in shade than the head and alitrunk. More rarely the ant is uniformly coloured.

The differences between this species and the closely related *bicarinatum* were tabulated in part 2 (Bolton, 1977) of this study. Basically, *insolens* differs from *bicarinatum* in having smooth mandibles, relatively long hairs on the frontal carinae (longer than maximum diameter of eye), gaster not darker in colour than alitrunk and the petiole a slightly different shape (compare Figs 43 and 45).

As a tramp-species *insolens* is by no means as successful as *bicarinatum*. It has a very wide range in the Pacific island-systems and is known from Indonesia, Philippines and the Solomon Islands. It was collected by E. O. Wilson in Sri Lanka, where it may be an introduction, and in England (in orchid house), Germany (zoological garden) and in the U.S.A. (near Los Angeles) where it is most certainly introduced. The Los Angeles specimens are deposited in USNM, Washington; for other localities see Bolton (1977).

Tetramorium pacificum Mayr

(Fig. 44)

Tetramorium pacificum Mayr, 1870 : 972, 976. Syntype workers, female, TONGA: Tongatabu (BMNH; NM, Vienna) [examined]. [For a statement of current synonymy of *pacificum* see Bolton, 1977 : 102.]

WORKER. TL 3·7–4·6, HL 0·86–1·10, HW 0·72–1·02, CI 83–90, SL 0·62–0·82, SI 79–87, PW 0·54–0·68, AL 1·04–1·30 (45 measured).

Mandibles usually unsculptured except for hair-pits but in some populations with feeble traces of striation. Anterior clypeal margin with a median notch or impression; median portion of clypeus with three strong longitudinal carinae. Frontal carinae long and strongly developed, usually approaching the occipital margin. Maximum diameter of eye *c.* 0·18–0·21, about 0·22–0·25 × HW. Propodeal spines long and acute, usually narrow and often somewhat upcurved along their length. Metapleural lobes acute and upcurved, usually broad. Petiole in profile characteristically shaped (Fig. 44), with the posterior face higher than the anterior so that the convex dorsum slopes upwards posteriorly and the posterodorsal angle is higher than the anterodorsal. Anterior face and dorsum confluent through a curve. Sculpture variable in density and intensity. On the head varying from a blanketing rugoreticulum to a system which is predominantly longitudinal but with cross-meshes present from the level of the anterior margins of the eyes; always with a reticulum posteriorly, close to the occiput. Ground-sculpture between rugae superficial but quite conspicuous. Dorsal alitrunk reticulate-rugose; often pedicel segments similarly sculptured but in some the sculpture predominantly longitudinal. First gastral tergite usually with at least traces of basal costulae; although these are often vestigial they are only rarely completely absent. Erect or suberect long hairs numerous on all dorsal surfaces of head and body. Colour a uniform dark brown, blackish brown or black.

T. pacificum ranges throughout the Oriental and Indo-Australian regions and occurs in northern Australia. It is very widespread in most or all of the island-systems of the Pacific (Wilson & Taylor, 1967; Bolton, 1977) and has been recorded from California in the U.S.A. (M. R. Smith,

1943; Creighton, 1950). The shape of the petiole in *pacificum* is unique amongst tetramoriines occurring in the New World and should serve to identify instantly this species.

The *simillimum*-group

Antenna with 12 segments. Sting appendage triangular or dentiform. Mandibles usually sculptured with striation or shagreening, rarely smooth. Anterior clypeal margin entire, without a median notch or impression. Frontal carinae variable, ranging from strong to vestigial but only rarely completely absent. Scrobes with all grades from absent to strong. Antennal scapes with SI $<$ 100. Propodeum armed usually with a pair of teeth or tubercles, never with spines, unarmed in one species; the propodeal teeth at most only as long as the metapleural lobes. Middle and hind tibiae without standing hairs of any description but usually with sparse appressed pubescence. Body hairs sparse, all dorsal surfaces with short, stout, blunt hairs, without fine or acute pilosity. Petiole narrowly nodiform in profile, in dorsal view usually as broad as or broader than long. Small to minute species, usually yellow or yellowish brown in colour, rarely otherwise.

This group is based on the Ethiopian region where about 15 species are present. Five species occur in Madagascar, two of which are endemic (p. 155) and one of which is shared with the Ethiopian region. The remaining two species are efficient tramp-forms of African origin which also occur in the New World, and are dealt with here.

Of the two there is no doubt that *simillimum* is the most successful. It has been widely recorded throughout the tropics and subtropics and also occurs fairly frequently in the temperate zones in zoological and botanical gardens and in conservatories and other constantly heated buildings.

Tetramorium caldarium (Roger) **stat. rev.**

(Figs 28, 42)

Tetrogmus caldarius Roger, 1857 : 12. Syntype worker, GERMANY: Prussia, 'Ananashause in Rauden' (BMNH) [examined] (previously treated as a synonym of *simillimum*, see note below).

Tetramorium pusillum var. *hemisi* Wheeler, 1922 : 193. Syntype workers, ZAIRE: Niangara, stomach of frog (*Hemisus marmoratum*) (*H. O. Lang*) (MCZ, Cambridge) [examined]. **Syn. n.**

Tetramorium antipodum Wheeler, 1927 : 143. Syntype workers, NORFOLK I.: 1915 (*A. M. Lea*) (MCZ, Cambridge) [examined]. **Syn. n.**

Tetramorium minutum Donisthorpe, 1942 : 30. Holotype female, EGYPT: Siwa, 17.vii.1935 (*J. Omer-Cooper*) (BMNH) [examined]. **Syn. n.**

Note. Roger (1862 : 297) synonymized his species *Tetrogmus caldarius* with *Tetramorium simillimum*, the latter being the senior name. His genus *Tetrogmus* rightly disappeared into the synonymy of *Tetramorium* but since then the name of the species which he described has consistently been referred to the synonymy of *simillimum*, where I left it in the second part of this study (Bolton, 1977). Since then the taxonomy of the *simillimum*-group has been studied in greater detail and it has become apparent that *caldarium* is a valid species, close to *simillimum* but consistently differing from it in the structure of the frontal carinae and in other details. From this finding *T. caldarium* is henceforth removed from the synonymy of *simillimum* and stands as a good species.

WORKER. Basically similar to *simillimum* and agreeing with the description of that species in most particulars, but differing as follows.

1. *Frontal carinae less strongly developed.* Generally the frontal carinae of *caldarium* are feeble throughout their length and usually weakly or not sinuate. They are best developed to the level of the midlength of the eye, behind which they become weak or broken, or fade out posteriorly, becoming indistinguishable from the cephalic rugulae in many cases. The low, raised flange or rim, which runs almost the length of the carinae in *simillimum*, is much weaker in *caldarium* and only developed to a level about equal to the midlength of the eye, behind which it quickly disappears.
2. *Antennal scrobes feeble.* In *simillimum* the antennal scrobes are shallow but are long and broad and distinctly concave, the effect being enhanced by the strong frontal carinae which delimit their dorsal and posterior margins. In *caldarium* the scrobes are much more weakly developed, very little concave and not bordered posteriorly. Also, the poor development of the frontal carinae makes the scrobes look very nondescript. Compare Figs 41 and 42.

3. *Cephalic ground sculpture weak.* In *caldarium* the strong reticulate-punctulation or granulation seen in *simillimum* is replaced by a much weaker granular or punctulate ground-sculpture between the rugulae, so that the head appears by no means as matt and rough.
4. *Head differently shaped.* In *simillimum* the head in full-face view tends to become broader from front to back, the sides diverging behind the level of the eyes, whereas in *caldarium* the width of the head does not noticeably increase posteriorly, compare Figs 41 and 42.

These characters in combination will differentiate the two species in the New World. The species will be treated in more detail in the part of this study dealing with the fauna of the Ethiopian region, as both have a number of closely related forms in that zoogeographical region.

Apart from the New World references given below, *caldarium* is widely distributed in Africa from Egypt to Kenya and occurs sporadically on islands such as the Cape Verde group, Mauritius, Madeira and St Helena. Occasionally it is introduced in Europe as the types from Germany and a series from Kew Gardens, London go to show, but it is hard to assess how often it is introduced or how successful the species is as no doubt many of the past identifications of *simillimum* in Europe should in fact have been referred to this species. *T. caldarium* is not known from Australia and seems to be uncommon throughout the Oriental and Indo-Australian regions. Three series are known from India but apart from this the only records of *caldarium* are the series from Norfolk Island which make up the types of the synonymous *antipodum* and three workers from New Caledonia.

In part two of this survey (Bolton, 1977 : 131) I gave *antipodum* as a provisional synonym of *simillimum* as at that time I had not been able to locate any members of the type-series. Since then a number of specimens referable to the type-series of *antipodum* have been found in the collections of MCZ, Cambridge and these show the species to be a straight synonym of *caldarium.*

MATERIAL EXAMINED (New World)
U.S.A.: Florida, St Augustine (*W. L. Brown*). **Mexico**: Rio Metlac, Veracruz Canyon (*A. Newton*); Nogales; Guerrero, Chilpancingo (*N. L. H. Krauss*). **Puerto Rico**: Mayaguez (*M. R. Smith*); Tres Hermanos (*M. R. Smith*); Coamo Springs (*W. M. Wheeler*). **Haiti**: Furcy (*W. M. Mann*). **Dominican Republic**: series on logs ex Dominica, intercepted at New York. **Colombia**: series on orchids ex Colombia, intercepted at New York (*S. D. Whittock*). **Brazil**: SP., Paracicaba (*C. A. Triplehorn*). **Peru**: Chaclacayo, E. Lima (*H. Crozier*).

Tetramorium simillimum (F. Smith)

(Figs 38, 41)

Myrmica simillima F. Smith, 1851 : 118. Syntype workers, GREAT BRITAIN: England, Dorset (types lost).
Tetramorium simillimum (F. Smith); Mayr, 1861 : 15, 61. [For a statement of current synonymy see Bolton, 1977 : 131 with the exception of *caldarium* (Roger), for which see above.]

WORKER. TL 2·1–2·5, HL 0·54–0·60, HW 0·48–0·54, CI 88–93, SL 0·36–0·42, SI 74–80, PW 0·34–0·40, AL 0·58–0·68 (45 measured).

Mandibles feebly striate or weakly shagreened, never strongly rugulose, rarely with sculpture almost effaced. Anterior clypeal margin convex and entire, without a median notch or impression. Frontal carinae strongly developed, weakly sinuate, extending back almost to the occiput and outcurved posteriorly, fading out around the posterior borders of the broad but shallow antennal scrobes. Eyes moderate in size, their maximum diameter 0·22–0·26 × HW. Occiptial margin of head in full-face view broadly but shallowly concave, the sides of the head broadened behind the eyes, weakly convex, merging into the evenly rounded occipital corners. Propodeum armed with a pair of short, triangular teeth which are usually shorter than the metapleural lobes, the latter broad and roughly triangular in shape. Petiole in profile as in Fig. 38, the node in dorsal view always slightly broader than long, somewhat variable in shape but always broadening posteriorly before narrowing to the postpetiolar junction. Dorsum of head finely longitudinally rugulose, the spaces between the rugulae packed with a fine, dense conspicuous reticulate-punctulation or granulation. Dorsal alitrunk finely, often faintly longitudinally rugulose, the spaces between rugulae densely punctulate. Dorsal petiole and postpetiole similarly but less strongly sculptured, the sculpture sometimes reduced but never completely absent. Gaster unsculptured or with faint granulation on base of first tergite. All dorsal surfaces of head and body with scattered short hairs, generally longer on the gaster then elsewhere. Hairs on alitrunk conspicuous, short, stout and blunt.

Antennal scapes and tibiae only with very short, fine pubescence which is appressed. Colour yellow to yellow brown, often with the gaster darker than the head and alitrunk but some populations uniformly coloured.

MATERIAL EXAMINED (New World)
U.S.A.: Florida, Orlando (*O. C. McBride*); Florida, Bradenton (*G. D. Reynolds*); Florida, Ft Ogden (*D. E. Read*); Florida, Ft Myers (*W. M. Barrows*); California, San Francisco (no further data). **Mexico**: Cordoba (*Mann & Skewes*); Cordoba (*Silvestri*); Chiapes, Ocosingo (*R. L. Dressler*). **Guatemala**: Los Amatea (*Kellerman*). **Bahamas**: Andros I. (*W. M. Wheeler*), Egg I. (*Wickham*). **Virgin Is.**: St Croix (*H. Morrison*). **Cuba**: Cristo (*W. M. Mann*); Soledad, Cienfuegos (*N. A. Weber*); Soledad, Atkins Gdns (*E. O. Wilson*). **Jamaica**: series without data; Balaclava (*W. M. Wheeler*). **Haiti**: Mts N. of Jacmel (*W. M. Mann*); Mannerville (*W. M. Mann*); Grande Riviere (*W. M. Mann*); Diquini (*W. M. Mann*). **Trinidad**: Curepe (*J. Noyes*); series ex Trinidad on palms, intercepted Philadelphia (*W. Chapman*). **Venezuela**: Caracas (*N. Perrine*); Orinoco Delta (*N. A. Weber*); P. Anduz, Moitaco. **Brazil**: Bahia (*H. L. Sumford*); S. P., San Sebastiao (*B. Fledderman*) Manaus (*Mann & Baker*). **Peru**: series ex Peru on orchids, intercepted Miami, Florida.

The *caespitum*-group

Antennae with 12 segments, sting appendage triangular to dentiform. Anterior clypeal margin entire, without a median notch or impression. Frontal carinae short, sometimes virtually absent, never extending back as far as posterior margins of eyes and generally much shorter. Antennal scrobes absent. Metanotal groove almost always impressed in profile, even if only weakly so. Propodeal spines short, usually reduced to a pair of triangular teeth, sometimes reduced to tubercles. Nodes of both petiole and postpetiole in dorsal view at least as broad as long, usually distinctly broader than long. Scapes and hind tibiae dorsally without long, erect or suberect hairs but often with suberect or subdecumbent-appressed pubescence. Dorsal surfaces of alitrunk, pedicel segments and gaster with elongate fine hairs at least in part, never with all hairs short, stout and blunt. Sculpture of head of fine, regular longitudinal rugulation or reduced, in some species the head virtually unsculptured.

This is the dominant and only endemic group of *Tetramorium* in the Palaearctic region. One species, *caespitum*, has been introduced into North America (M. R. Smith, 1943; Brown, 1957) and it is now well established in the U.S.A. with a wide range on that continent (Creighton, 1950).

The taxonomy of the *caespitum*-group is in a very poor state, with over 100 names, the majority described as infraspecific or infrasubspecific forms of *caespitum* itself and many of the names based on meaningless characters or represented by descriptions which can only be called valueless. Because of this a formal description of *caespitum* is not given here, but the species as it occurs in North America should be easily recognizable from the following summary as it is the only member of its group established on that continent.

Tetramorium caespitum (L.)

(Figs 37, 49)

Formica caespitum L., 1758 : 581. Holotype female, EUROPE ('in Europae tuberibus') (holotype not in Linnean Society collection, London).

Tetramorium caespitum (L.); Mayr, 1855 : 426.

Tetramorium caespitum var. *immigrans* Santschi, 1927 : 54. Syntype workers, CHILE: Valparaiso (*Miss Edwards*) (probably in NM, Basle; not seen). **Syn. n.**

Myrmica (*Myrmica*) *brevinodis* var. *transversinodis* Enzmann, 1946 : 47, figs 1, 2. Holotype worker, U.S.A.: Massachusetts, Dedham (in private coll. J. Enzmann; not seen). [Synonymy by Brown, 1949 : 47; also Creighton, 1950 : 291.]

WORKER. With the group characters given above; the head densely and finely longitudinally rugulose everywhere. Spaces between rugulae with feeble ground sculpture, mostly shining. Head without unsculptured patches, without reticular or rugoreticular sculpture. Dorsal alitrunk longitudinally rugulose but on the posterior portion of the propodeal dorsum the rugulae being replaced by fine reticulate-punctate sculpture. Dorsal surfaces of petiole and postpetiole finely sculptured but each with a smooth

median area or smooth median longitudinal strip. First gastral tergite unsculptured. Metanotal groove impressed in profile, the propodeal spines usually slightly longer than their basal width, but sometimes represented only by a pair of broadly triangular teeth. Pubescence of hind tibiae short and fine, decumbent to appressed.

During this study I have examined specimens from Massachusetts, New York and Pennsylvania, all falling within the range given by Creighton (1950). The var. *transversinodis* of Enzmann, noted above, is accepted as an absolute synonym of *caespitum* without question for, although I have not seen the holotype, the figures and description fit the species very well.

The status of var. *immigrans* is a little more dubious. It was first recorded from Chile by Santschi (1922) as *T. caespitum* but later he described it as *caespitum* var. *immigrans* (1927), both records being based on the same specimens from Valparaiso. Snelling & Hunt (1975) in their review of the Chilean ant fauna note the 1922 record but state that they had seen no material in their survey. Under these circumstances I think it best to assume that the Chilean record represents a casual introduction and to refer *immigrans* to the synonymy of *caespitum*. Sporadic introductions of *caespitum* in the neotropics are probably uncommon but I have seen material originating in Belize and Mexico during the course of this investigation.

The *camerunense*-group

Antennae with 12 segments. Sting appendage dentiform to pennant-shaped. Mandibles usually smooth but delicately striate in some species. Anterior clypeal margin with a small median notch or impression. Frontal carinae reaching back almost to occiput but not strongly developed. Antennal scrobes feebly developed. Head in full-face view not rectangular, usually with sides slightly but evenly convex and narrowing in front of the eyes. Propodeum strongly bispinose. All dorsal surfaces with numerous long, standing hairs, but scapes and hind tibiae only with short decumbent or appressed pubescence. Petiole nodiform in profile. Sculpture of dorsum of head of fine, longitudinal, roughly parallel rugulae, without a coarse rugoreticulum.

The *camerunense*-group is based upon West and Central Africa, where about 13 species are known. One species of the group, *lucayanum*, was described from the Bahamas and Brown (1957) voiced the opinion that the species was probably of African origin. Later Brown (1964*a*) proved this to be the case when he found specimens from the Ivory Coast, Liberia and Zaire (type of *waelbroeki*) which matched up with material of *lucayanum* from Jamaica.

At present the known New World distribution includes Cuba, Puerto Rico, Jamaica, Virgin Islands and Bahamas (type-locality) as recorded by Brown (1964*a*); and in Africa it occurs in Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Fernando Po I. and Zaire.

Tetramorium lucayanum Wheeler

(Figs 36, 48)

Tetramorium lucayanum Wheeler, 1905 : 100, fig. L. Syntype workers, BAHAMAS: N.P., Nassau, Queen's Staircase (*W. M. Wheeler*) (AMNH, New York) [examined].

Tetramorium camerunense var. *waelbroeki* Forel, 1909 : 53. Holotype worker, ZAIRE: Kinchassa (= Kinshasha) (NM, Basle) [examined]. [Synonymy by Brown, 1964*a* : 131.]

Tetramorium lucayanum var. *sexdens* Forel, 1915 : 357. Syntype workers, IRELAND: Dublin, in greenhouse (MNH, Geneva; BMNH) [examined]. [Synonymy by Brown, 1964*a* : 131.]

Tetramorium rectinodis Menozzi, 1942 : 176, fig. 2B. Syntype workers, FERNANDO PO: Musola, 9.ix.39; San Carlos, x.39 (*H. Eidmann*) (types presumed lost, not in Menozzi coll. at IE, Bologna). [This species also described as new by Menozzi, 1944 : 454. Provisional synonymy of Brown, 1964*a* : 131, here confirmed.]

WORKER. TL 2·8–3·2, HL 0·72–0·80, HW 0·64–0·71, CI 86–91, SL 0·54–0·61, SI 82–87. PW 0·46–0·53, AL 0·80–0·92 (30 measured).

Mandibles usually very feebly longitudinally striate but almost smooth in some populations. Anterior clypeal margin with a weak median impression or notch. Frontal carinae extending back almost to the occiput, forming the dorsal margins of the shallow and broad antennal scrobes. Outline shape of alitrunk

and pedicel segments as in Fig. 36. Propodeum armed with a pair of elongate straight spines, the metapleural lobes elongate-triangular and acute, usually upcurved but less commonly almost straight. Petiole in profile with the node ascending vertically from the peduncle, the anterior and dorsal faces meeting in a sharp right-angle. The posterodorsal angle of the node is distinctly more rounded than this. In dorsal view the petiole node with a low but sharp carina traversing the anterior face, the node longer than broad even if only slightly so. Dorsum of head with well spaced out, sharply defined longitudinal rugulae without any cross-meshes and without trace of a rugo-reticulum occipitally, the spaces between the rugulae virtually smooth, with only the faintest traces of ground sculpture. Dorsal alitrunk similarly but less regularly sculptured, sometimes with a few weak cross-meshes, at least on the mesonotum. Petiole dorsum irregularly and quite strongly rugulose, distinctly more strongly sculptured than the postpetiole which has only scattered weak longitudinal rugulae dorsally. Gaster unsculptured. All dorsal surfaces of head and body with numerous standing hairs; antennal scapes and tibiae without such hairs, only with fine dense pubescence. Colour uniform mid-brown to black, the appendages usually somewhat lighter in shade than the body.

MATERIAL EXAMINED (New World)
Bahamas: Nassau (*W. M. Mann*). **Virgin Is.**: St Croix (*W. F. Buren*). **Puerto Rico**: Mayaguez (*M. R. Smith*). **Jamaica**: Kingston (*W. M. Wheeler*). **Cuba**: Cienfuegos (*W. M. Wheeler*); Guantanamo (*W. M. Mann*); Cristo (*W. M. Mann*); Oriente, Yateras Dist. (*W. M. Mann*).

Additions and corrections to previous parts (Bolton, 1976; 1977) of this study

Rhoptromyrmex mayri Forel

Rhoptromyrmex mayri Forel, 1912: 57. Syntype females, INDIA: Poona (*Wroughton*) (BMNH) [examined].
Hagioxenus mayri (Forel); Brown, 1964*b* : 19.

Brown (1964*b*) indicated that this species was not a member of *Rhoptromyrmex* and proposed that it be transferred to genus *Hagioxenus* Forel, where it was left in the first part of this study (Bolton, 1976). Since then I have found four syntype females in the BMNH collection and dissection of two of them has shown that *mayri* is in fact correctly placed in *Rhoptromyrmex*, to which genus it is now formally returned.

The only *Rhoptromyrmex* species known from workers in India is *R. wroughtonii* Forel, and strangely the female of this species has not yet been discovered. It is tempting to assume that *mayri* represents the unknown female of *wroughtonii* but the differences between worker and queen seem greater than can be accounted for by the presumed parasitic lifeway of the females of this genus. In particular the pilosity in the queens representing *mayri* is much more dense and conspicuous than in *wroughtonii* workers, with spectacularly long hairs arising all over the legs and antennal scapes, which are absent from *wroughtonii* workers. On its own this character may not be significant but I think it best to leave the two separate until queen-associated samples of *wroughtonii* are forthcoming.

Tetramorium melanogyna Mann **sp. rev.**

Tetramorium melanogyna Mann, 1919 : 345, fig. 28. Syntype workers, female, SOLOMON Is.: Ugi, Pawa, 1916 (*W. M. Mann*) and Three Sisters, Malapaina, 1916 (*W. M. Mann*) (MCZ, Cambridge; USNM, Washington) [examined].
Tetramorium melanogyna Mann; Bolton, 1977 : 99 [as synonym of *T. insolens* (F. Smith)].

A critical reappraisal of the material of *melanogyna* presently available for study has convinced me that I was mistaken in synonymizing this species with the much more widespread *T. insolens*, and I hereby reverse that decision, restoring *melanogyna* to its original status as a good species.

As far as is known *melanogyna* is restricted to the Solomon Islands and thus it is only specimens from here which may be confused with *insolens*, which also occurs on these islands. Samples of *melanogyna* workers will key out at *insolens* in Bolton (1977), but the two may be distinguished as follows.

insolens	*melanogyna*
Gaster lighter in shade than head and alitrunk.	Gaster darker in shade than head and alitrunk, or at least with an infuscated transverse band.
Hairs on dorsal (outer) surface of hind tibiae suberect to subdecumbent.	Hairs on dorsal (outer) surface of hind tibiae decumbent to appressed.
Rugoreticulum on postpetiole dorsum very strong, as well developed as on pronotum.	Rugoreticulum on postpetiole dorsum weak, more feebly developed than on pronotum.
In a majority of workers the rugose sculpturing of the alitrunk forming a transverse ridge at promesonotal junction.	Rugose sculpturing of alitrunk not forming a transverse ridge at promesonotal junction.

The queens of the two species are easily distinguished as in *insolens* the female has the same colouring as the workers, whilst in *melanogyna* the queen is uniform dark brown. Other names given as synonyms of *insolens* in Bolton (1977 : 99) remain as such.

Correction to key. In the key to *Tetramorium* of the Oriental and Indo-Australian regions (Bolton, 1977 : 72), the second half of couplet 13 should read, 'Dorsum of postpetiole unsculptured . . .', not 'Dorsum of petiole' as is printed. This brings it in line with the first half of the couplet.

Tetramorium belgaense Forel

(Fig. 59)

Tetramorium (*Xiphomyrmex*) *belgaense* Forel, 1902 : 238. Holotype female, INDIA: Mysore, Belgaum (*Wroughton*) (MHN, Geneva) [examined].

WORKER (previously undescribed). TL 3·3–4·0, HL 0·74–0·80, HW 0·66–0·70, CI 87–89, SL 0·58–0·64, SI 88–92, PW 0·52–0·58, AL 0·90–1·00 (10 measured).

Antennae with 11 segments. Mandibles finely longitudinally striate. Anterior clypeal margin entire, without a median notch or impression. Frontal carinae long, reaching back almost to occiput and distinctly more strongly developed than other cephalic sculpture. Eyes relatively large, maximum diameter 0·19–0·21, about 0·28–0·30 × HW. Alitrunk in profile with the dorsum evenly convex, the propodeal spines long and narrow, feebly upcurved along their length, twice as long as the acutely triangular metapleural lobes. Petiole in profile with a roughly rectangular node, the anterior face vertical and meeting the shallowly convex dorsum in a blunt right-angle. Posterodorsal angle of node distinctly more rounded than antero-dorsal. Postpetiole in profile high and narrow, the tergum higher than long. Dorsum of head with widely spaced sharp longitudinal rugae with sparse cross-meshes which are less strongly developed and with a narrow reticulum occipitally. Dorsal alitrunk reticulate-rugose, the petiole dorsum similarly but less strongly sculptured. Postpetiole dorsally with a median strip which is punctulate or unsculptured but this is flanked on each side by rugulose sculpture. Gaster unsculptured. All dorsal surfaces of head and body with numerous elongate erect hairs but the scapes and outer tibial surfaces only with fine pubescence. Colour light brown, the appendages yellow, the gaster darker than the head and alitrunk.

In the key to species (Bolton, 1977 : 72) *belgaense* will run out at couplet 12 along with *yerburyi* Forel. The two are immediately separable as the Sri Lankan *yerburyi* is much larger (HW 0·94–1·04, PW 0·70–0·74) with relatively longer antennal scapes (SI 98–102). Apart from these mensurable characters *yerburyi* has long stout hairs projecting from the dorsal (outer) surface of the hind tibiae where only short pubescence is present in *belgaense*, and in *yerburyi* the metapleural lobes are low and blunt, very obtusely triangular at most, whereas in *belgaense* they are narrowly and acutely elongate-triangular.

In one respect it is difficult to fit *belgaense* into the key as its SI falls between the two limits given in couplet 8, where the first half has SI 75–86, and the second half 90–105. However, as the range of *belgaense* is 88–92 it was decided to run it through the second half of couplet 8 as its measured SI is above the upper level of the range given in the first half whilst its upper level is within the range given in the second half of the couplet.

MATERIAL EXAMINED

India: Mysore, 10 miles [23 km] S. Haliyal, 500 m, 16.ii.1962 (*E. S. Ross & D. Cavagnaro*).

Tetramorium palaense n. sp.

(Fig. 56)

HOLOTYPE WORKER. TL 3·9, HL 0·92, HW 0·84, CI 91, SL 0·78, SI 93, PW 0·67, AL 1·14.

Antennae with 11 segments. Mandibles finely longitudinally striate. Clypeus without a median notch but the anterior apron with a feeble impression. Frontal carinae long and strong, sinuate, almost reaching occiput before becoming indistinguishable from remaining rugose sculpture. Propodeal spines long and narrow, slightly upcurved apically in profile. Metapleural lobes elongate-triangular. Node of petiole in profile long and low, with a short anterior face, a long, gently convex dorsum and a long posterior face, the posterodorsal angle rounded; postpetiole in profile low and evenly shallowly convex dorsally. Petiole in dorsal view longer than broad. Entire dorsum of head coarsely reticulate-rugose, the clypeus similarly sculptured and without a median longitudinal carina. Dorsal alitrunk coarsely reticulate-rugose as the head, the reticular spaces on both head and alitrunk mostly smooth, with only very feeble superficial ground-sculpture. Sides of petiole and postpetiole rugulose, the latter more feebly so than the former. Dorsum of petiole with an unsculptured shining median longitudinal strip, dorsum of postpetiole unsculptured. First gastral tergite unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous elongate hairs, the largest of those on the alitrunk longer than those on the first gastral tergite. Dorsal (outer) surfaces of hind tibiae with scattered short, erect to suberect hairs, the scapes with short fine hairs. Colour blackish brown.

PARATYPE WORKERS. As holotype, the colour varying from dark brown to almost black and with a range of dimensions TL 3·7–4·0, HL 0·86–0·94, HW 0·78–0·86, CI 90–93, SL 0·72–0·80, SI 90–95, PW 0·62–0·70, AL 1·06–1·18 (34 measured).

Holotype worker, **Borneo**: Sarawak, 4th Division, Gunong Mulu Nat. Pk, R.G.S. Expd., Long Pala, 19.ix.1977, lowl. rainfor., soil pocket on rock (*B. Bolton*) (BMNH).

Paratypes. 27 workers with same data as holotype and 24 workers with same data but 20.ix.1977 (BMNH; MCZ, Cambridge; NM, Basle; USNM, Washington; MHN, Geneva).

Very closely related to *vertigum* Bolton of Sulawesi and running to that species in the key (Bolton, 1977 : 73); *palaense* is best separated as follows.

palaense	*vertigum*
Frontal carinae strong, almost reaching to occiput.	Frontal carinae weak, quickly fading out behind level of eyes.
Antennal scrobes developed.	Antennal scrobes vestigial.
Posterior face of petiole not convex in profile, not overhanging petiole–postpetiole junction.	Posterior face of petiole convex in profile, overhanging petiole–postpetiole junction.
Side of postpetiole rugulose.	Sides of postpetiole smooth.
Antennal scapes shorter, SI 90–95.	Antennal scapes longer, SI 97–105.
Anterior clypeal apron slightly indented medially.	Anterior clypeal apron evenly convex.

Tetramorium rekhefe sp. n.

(Fig. 58)

HOLOTYPE WORKER. TL 3·6, HL 0·86, HW 0·80, CI 93, SL 0·70, SI 87, PW 0·60, AL 0·96.

Antennae with 12 segments. Mandibles coarsely longitudinally striate. Anterior clypeal margin entire, the median portion flat to very slightly concave. Frontal carinae more strongly developed than rugose sculpture of head, approaching occipital margin. Sides of head behind eye in full-face view shallowly but evenly convex. Eyes moderate, maximum diameter 0·18, about 0·22 × HW. Alitrunk in profile short and deep, the metanotal groove impressed. Propodeal spines long and strong, fully three times longer than the upcurved triangular metapleural lobes. Peduncle of petiole long and downcurved along its length. Petiole node in profile relatively high and narrow, the tergal portion higher than the dorsum is long, the dorsal surface shallowly convex and both antero- and posterodorsal angles rounded. In dorsal view the petiole node considerably broader than long. Clypeus with three longitudinal carinae. Dorsum of head with seven irregular but widely spaced longitudinal rugae between frontal carinae at level of eyes, these anastomosing and forming a weak occipital reticulum. Spaces between the rugae smooth, with only the

most superficial traces of ground-sculpture. Dorsal alitrunk with a loose, wide-meshed open rugoreticulum, the interspaces shining. Petiole and postpetiole everywhere with a feeble superficial punctulation, the former also with faint rugular traces laterally. First gastral tergite with feeble traces of a superficial reticulum which is not raised but rather forms a faint surface pattern. All dorsal surfaces of head and alitrunk with numerous fine hairs but the dorsal (outer) surfaces of the hind tibiae only with short pubescence which is decumbent or strongly curved. Colour dark reddish brown, the gaster and pedicel blackish brown.

PARATYPE WORKERS. As holotype but with 7–8 cephalic rugae and measuring HL 0·88–0·90, HW 0·82–0·83, CI 92–93, SL 0·70–0·72, SI 84–87, PW 0·60–0·63, AL 0·98–1·04 (2 measured).

Holotype worker, **Portuguese Timor**: Baucau, 29–31.vii.1972 (*W. L. Brown*) (MCZ, Cambridge).
Paratypes. Two workers with same data as holotype (MCZ, Cambridge; BMNH).

This species is a member of the *ornatum*-group and is closely related to *navum* Bolton, to which point it runs in the key. The two are separated by the following.

navum	*rekhefe*
Median portion of clypeus with 5 carinae.	Median portion of clypeus with 3 carinae.
Cephalic sculpture of very strong carinae.	Cephalic sculpture of feebler rugae.
Petiole node in dorsal view longer than broad.	Petiole node in dorsal view much broader than long.
Tergum of petiole node longer than high.	Tergum of petiole node higher than long.
Petiole dorsum rugulose, postpetiole dorsum unsculptured.	Dorsum of both petiole and postpetiole weakly superficially punctulate.
Scapes relatively and absolutely shorter, SL 0·56–0·64, SI 76–81.	Scapes relatively and absolutely longer, SL 0·70–0·72, SI 84–87.

Tetramorium ocothrum sp. n.

(Fig. 57)

HOLOTYPE WORKER. TL 2·9, HL 0·64, HW 0·56, CI 87, SL 0·47, SI 84, PW 0·42, AL 0·70.

Antennae with 12 segments. Mandibles delicately longitudinally striate. Anterior clypeal margin convex and entire. Frontal carinae reaching a level about halfway between posterior margins of eyes and occipital corners, weak throughout their length, no stronger than the cephalic sculpture with which they merge posteriorly. With head in full-face view the sides evenly convex, the occipital margin transverse, not concave medially. Eyes moderate, maximum diameter 0·12, about 0·21 × HW, situated in front of the midlength of the sides. Dorsal alitrunk evenly convex in profile, in dorsal view the pronotal corners rounded. Propodeal spines short, narrow and spiniform, slightly longer than the acute triangular metapleural lobes. Petiole in profile with a long, downcurved anterior peduncle and a low dome-shaped node with broadly rounded antero- and posterodorsal angles and an evenly convex dorsum. In dorsal view the petiole node subglobular, slightly broader than long. Postpetiole with an anterior peduncle which is narrower than the node itself, the whole segment longer than broad. Dorsum of head covered with a mass of fine, irregular, dense confused rugulation, the interspaces finely punctulate. Dorsal alitrunk with a fine open rugoreticulum. Petiole and postpetiole unsculptured dorsally but the former with lateral traces of faint punctulation. Gaster unsculptured. All dorsal surfaces of head and body with numerous elongate fine hairs but the dorsal (outer) surfaces of the hind tibiae only with short, appressed pubescence. Colour black.

Holotype worker, **Borneo**: Sarawak, 4th Division, Gunong Mulu Nat. Pk, RG.S.. Expd. Long Pala, lowl. rainfor., on tree trunk, 14.x.1977 (*B. Bolton*) (BMNH).

A species of the *tonganum*-group, most closely related to *tonganum* itself and running out with that species in the key (Bolton, 1977 : 77). The two are quickly separable by colour, *tonganum* being yellowish brown or mid-brown whilst *ocothrum* is black. Apart from this the eyes of *tonganum* are slightly larger (0·24–0·27 × HW) and the cephalic sculpture is more regular, not so nearly disorganized in appearance as in *ocothrum*.

The *obtusidens*-complex

In the previous part of this study (Bolton, 1977 : 101) a number of samples were treated under the name *T. obtusidens* Viehmeyer, and I said at the time that, 'I suspect that the name *obtusidens* may conceal more than one valid species'. Now I am of the opinion that three separate species exist in this complex of the *bicarinatum*-group. They are characterized within the group by their small size (HW<0·65, SL<0·55), smooth unsculptured mandibles, pale yellow colouring and vestigial or absent basigastral sculpture. All three will run out to *obtusidens* in the 1977 key but may be separated as follows.

a Alitrunk in dorsal view with a strong transverse carina at the pro-mesonotal junction. Postpetiole dorsum with strong rugulose sculpture. (Thailand, Borneo) . . . ***adelphon*** (p. 177)
– Alitrunk in dorsal view without a transverse carina at the pro-mesonotal junction. Postpetiole dorsum punctulate or with 1–2 very faint rugulae . . . . . b
b Hairs on dorsal alitrunk abundant, fine, curved or sinuate. Smaller species, HW<0·55. (Singapore) . . . . . ***obtusidens*** (p. 178)
– Hairs on dorsal alitrunk sparse, stout, more or less straight and blunted apically. Larger species, HW>0·55. (New Guinea) . . . . . ***kydelphon*** (p. 177)

Tetramorium adelphon sp. n.

HOLOTYPE WORKER. TL 2·8, HL 0·68, HW 0·58, CI 85, SL 0·48, SI 83, PW 0·43, AL 0·78.

Antennae with 12 segments. Mandibles unsculptured, smooth and shining with scattered hair-pits. Anterior clypeal margin with a shallow median impression. Frontal carinae strong and running almost to occipital corners before blending into the occipital rugoreticulum, and surmounted to this point by a narrow raised rim or flange. Maximum diameter of eye 0·17, about 0·29 × HW. Propodeal spines in profile elongate and narrow. Metapleural lobes triangular, broad basally but rapidly tapering to an acute apex. Petiole node in profile shaped as in *insolens* (Fig. 45, this paper), longer than broad in dorsal view. Clypeus sculptured only with the three longitudinal carinae typical of this group. Dorsum of head in front of the level of the eyes with 5 longitudinal rugulae between the frontal carinae, occipitally with a strong rugoreticulum and between these two zones with an area in which the longitudinal rugulae continue but which also has a few cross-meshes. Dorsal alitrunk reticulate-rugose and with a strong transverse carina at the junction of pro- and mesonotum. Petiole dorsum reticulate-rugulose, postpetiole dorsum similarly but less strongly sculptured. First gastral tergite without basal costulae. All dorsal surfaces of head and body with stout, stiff erect or suberect hairs. Colour pale yellow.

Holotype worker, **Borneo**: Sarawak, 4th Division, Gunong Mulu Nat. Pk, R.G.S. Expd. Long Pala, lowl. rainfor., leaf litter, 28.ix.77 (*B. Bolton*) (BMNH).

NON-PARATYPIC MATERIAL

Also placed in this species is a single worker from Thailand: Nong Hoi, 21.vii.1975 (*D. Jackson*) which closely resembles the holotype but has the anterodorsal petiole angle rather more acutely developed. It has almost the same measurements as the holotype (TL 3·0, HL 0·70, HW 0·61, CI 87, SL 0·50, SI 82, PW 0·44, AL 0·80) and shares the diagnostic characters of the holotype.

The strong transverse carina on the dorsal alitrunk quickly separates *adelphon* from related species in the Oriental and Indo-Australian regions, but this character also occurs in the small yellow African species related to *phasias* Forel, which may turn out to be more closely related to *adelphon* than either *obtusidens* or *kydelphon*.

Tetramorium kydelphon sp. n.

HOLOTYPE WORKER. TL 3·4, HL 0·78, HW 0·64, CI 85, SL 0·52, SI 81, PW 0·48, AL 0·92.

Antennae with 12 segments. Anterior clypeal margin with a very feeble median indentation. Mandibles unsculptured except for hair-pits. Frontal carinae strong, running almost to occipital corners before becoming confused with the occipital rugoreticulum and surmounted throughout their length by a narrow raised rim or flange. Maximum diameter of eye 0·18, about 0·28 × HW. Propodeal spines elongate but broad in profile, elevated. Metapleural lobes narrowly elongate-triangular. Petiole node in profile shaped as in *insolens* (Fig. 45, this paper), in dorsal view as broad as long. Dorsum of head with irregular,

spaced-out longitudinal rugulae and with a weak occipital rugoreticulum. Dorsal alitrunk reticulate-rugose but without a transverse carina at the pro- and mesonotal junction. Petiole dorsum weakly rugulose, the postpetiole dorsally with a few very faint longitudinal markings and a little very feeble punctulation. Gaster unsculptured. All dorsal surfaces of head and body with stout, stiff, erect or suberect hairs. Colour pale yellow.

Holotype worker, **New Guinea**: Papua, Karema, Brown R., no. 601, 8–11.iii.1955 lowl. rainfor. (*E. O. Wilson*) (MCZ, Cambridge).

Paratypes. A worker and a queen with same data as holotype (BMNH). Also to be included as paratypes are other members of this series and two New Guinea series from Lai and Huon Peninsula, Lower Busu River (*E. O. Wilson*) at present housed in MCZ, Cambridge and referred previously (Bolton, 1977 : 102) to *obtusidens*.

Tetramorium obtusidens Viehmeyer

Following the removal of *adelphon* and *kydelphon* from the series formerly associated with *obtusidens* it is necessary to make a few adjustments to the description of this species.

WORKER. TL 2·4–2·7, HL 0·58–0·64, HW 0·49–0·54, CI 81–85, SL 0·38–0·42, SI 77–80, PW 0·34–0·38, AL 0·68–0·74 (8 measured).

With the general characters of the complex and of the *bicarinatum*-group to which it belongs, but with additional characters as follows. Frontal carinae less strongly developed than in *adelphon* or *kydelphon*, extending back beyond level of eye but weak, scarcely stronger than other cephalic rugulae. Maximum diameter of eye 0·12–0·14, about 0·25–0·27 × HW. Petiole node in dorsal view as broad or slightly broader than long. Dorsum of head irregularly longitudinally rugulose, with a reticulum occipitally. Dorsal alitrunk reticulate-rugulose but without a raised transverse carina at the promesonotal junction. Petiole dorsum with sparse rugulae, postpetiole dorsally with fine superficial punctulation, at most with only one or two very feeble longitudinal marks. Pilosity on dorsal surfaces of head and body much denser than in *adelphon* or *kydelphon*, the individual hairs finer and more flexuous than in those species. Colour pale yellow.

With the removal of *adelphon* and *kydelphon*, *obtusidens* is known only from Singapore. To the present it is the smallest known member of the *bicarinatum*-group.

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Synonyms are printed in *italics*.